A MULTIDIMENSIONAL APPROACH TO THE STUDY OF PRENATAL COCAINE EXPOSURE

By

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By

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Chairman: Barbara A. Zsembik, Ph.D.
Major Department: Sociology

OBJECTIVE: Using longitudinal data this research seeks to determine the prenatal, neonatal, and postnatal predictors of adaptive behavior and early childhood development among children who were prenatally exposed to cocaine. This research uses a multidimensional and integrative approach to examine how sociological, behavioral, and biomedical factors influence the behavior and development of a group of children "at-risk" of poor developmental outcomes. The respective influence of prenatal cocaine exposure (PCE), the health status of the infant at birth, the psychosocial status of the primary caregiver, the home environment, the families' social supports, and social structural variables are included as determinants.

METHOD: This study utilizes data collected for a longitudinal study on the impact of prenatal cocaine exposure on children. The study sample includes 115 prenatally cocaine exposed children and 119 controls. The sample is predominantly comprised of poor, Black children from single parent households who are "at-risk" of

developmental delays because of the problems associated with maternal drug use, a typical consequence of social and economic disadvantage. Using bivariate and multivariate analysis, this study tests the utility of a multidimensional approach designed to contribute to our understanding of the relationship between PCE and the measured outcomes.

RESULTS: The bivariate and multivariate analyses indicate that there is no relationship between PCE and the behavioral and developmental outcomes of three-year old children. Both behavior and development are significantly correlated with the home environment, the families' social support mechanism, and the families' social demographics. The quality of the parenting environment within the home is the strongest predictor of behavior followed by the families' social demographics and the infant's health status at birth. The infant's neonatal health status and the families' social demographic were the most significant predictors of development. The multidimensional model, which integrates measures of the prenatal, neonatal, and postnatal environments, proved to be a stronger model than the prenatal or prenatal and neonatal model combined, thus providing evidence that despite the risk associated with prenatal cocaine exposure, "at-risk" children exhibit resiliency when placed in positive postnatal environments.

CHAPTER 1
INTRODUCTION

Children who have been prenatally exposed to crack cocaine have been characterized as "at-risk" of exhibiting a variety of developmental and behavioral problems (Azuma and Chasnoff 1993; Chasnoff 1988; Chasnoff, Lewis, Griffith, Willey 1989; Frank, Zuckerman, Amaro, Aboagye, Bauchner, Cabral, Fried, Hingson, Lynne, and Levenson 1988; Tronick, Frank, Cabral, Mirochnick, and Zuckerman 1996). According to the Robert Wood Johnson Foundation, over 80,000 children will have subtle deficits in their intellectual and language development as a consequence of prenatal cocaine exposure. These presumed deficits have an anticipated cost to the nation of nearly $352 million per year for special education programs (Lester, LaGasse, and Seifer 1998). It has not been determined through the use of sound empirical research methods whether or not the anticipated and observed problems are a consequence of the actual physiological effect cocaine has on the developing fetus and surviving child or the social and environmental consequences of being born to a drug addicted mother who may have difficulty caring for her child.

There is a long history of research on the numerous social and environmental factors that contribute to children's delayed development and problematic behavior. In many of these studies, African-American children are disproportionately considered "at-risk" due to the adverse effects of poverty on their health and over all well-being (Federal Interagency Forum of Child and Family Statistics 1997; U. S. Department of Health and

Human Services 1995). Poor children are "at-risk" because of the problems associated with family and community disintegration (Kendall-Tackett and Eckenrode 1996; Wilson 1987) and family violence (Deater-Deckard, Bates, Dodge, and Pettit 1996; Dodge, Pettit, Bates 1994; Kendall-Tackett and Eckenrode 1996). Disconcertingly, poverty, family and community disintegration, and poor family dynamics are factors that characterize the lives of women who abuse drugs and the lives of the children they bear (Coy 1997). Consequently, it is difficult to determine whether or not prenatal cocaine exposure or some postnatal social environmental factor is responsible for the developmental and behavioral problems presumably exhibited by "at-risk" children.

This study uses an integrative approach to examine the sociological and the biomedical determinants of early childhood behavior and development for children defined as "at-risk" due to their prenatal cocaine exposure. Specifically, this research will address the following: (1) the differences in the behavior and development of prenatally and non-prenatally cocaine exposed children and (2) to what extent the behavior and development of pre-school aged children is either enhanced or hindered by biomedical, behavioral, and sociological factors found in the prenatal and postnatal environments.

Drawing from the health integrative approach advocated for by the Committee on Future Directions for Behavioral and Social Sciences Research at the National Institutes of Health (Singer and Ryff 2001), I hypothesize that the behavior and development of young children are not only dependent on physiological (biomedical) factors derived in the prenatal environment, but that they are highly dependent on neonatal factors, such as the child's health status at birth and postnatal factors, such as the social structure, social

support networks, the physical environment, and interpersonal relationships. This study seeks to determine the influence of prenatal, neonatal, and postnatal factors on the behavior and development of children at age three, a critical stage of maturation in early childhood development.

The predominant belief upheld by popular culture is that children who have been prenatally exposed to cocaine are "at-risk" of poor developmental outcomes and that their behavioral problems are placing a drain on social, educational, and economic resources (Blakeslee 1990; Bragg 1998; Gross 1993; Hinds 1990; Toufexis 1990). The media have helped perpetuate this common belief by creating the image of the "crack baby" and the out of control drug exposed child or "crack kid." However, much of the scientific research on prenatally cocaine exposed children has provided very little evidence that cocaine exposed children have any more problems than other children who have survived unhealthy prenatal experiences.

Much of the research on the behavior and development of young children who have been prenatally exposed to cocaine has been contradictory and/or inconclusive. There are several reasons for the inability of researchers to establish a clear connection between prenatal cocaine exposure and subsequent behavior and development. One reason is that there are only a few longitudinal studies on prenatally cocaine exposed children. Moreover, most researchers are still in the process of collecting and analyzing data that include outcome measures for pre-school and school-aged children. Second, the majority of studies that have been published have taken a biomedical or behavioral approach ignoring the role of social and environmental factors.

This study is empirically unique in that the data come from a longitudinal project funded by the National Institute on Drug Abuse, which contains data for a matched control group of prenatally cocaine exposed children from birth through age seven. This research addresses the developmental concerns of the children at age three. Furthermore, this research is theoretically unique, because it is written from the perspective of a social scientist with a multidisciplinary background including training in sociology, neuropsychology, counseling, and education. This background predisposes me to integrate multiple disciplinary ideas, as I seek to understand how numerous systems interact with one another and how these systems influence different aspects of our social lives.

In this research, I raise the question of whether or not prenatal cocaine exposure, a consequence of a mother's behavior during pregnancy, is more influential than the biomedical health risk determined neonatally and postnatal factors, including socioeconomic status, family social support, the home environment, and the primary caregiver's psychosocial status. As a social science researcher, I intend to shed light on a topic that has been dominated by medical and behavioral researchers. By identifying the additive effect of biomedical and social environmental factors associated with behavioral and developmental outcomes among "at-risk" children, researchers and practitioners can better ascertain the role these factors play in the lives of prenatally cocaine exposed children. Then, we can create interventions that may reduce the negative impact of the prenatal environment by accentuating the positive attributes found in the postnatal environment.

Using a sociological perspective and the basic tenets of human ecology and resiliency theory outlined in Chapter 3, I have created a conceptual model that will be used to ascertain the effect of the prenatal, neonatal, and postnatal environments on the behavior and development of the children included in this research. The compensatory model of resilience describes the mechanism by which the neonatal and postnatal environments mediate the effect of the prenatal environment on early childhood outcomes. The children's prenatal exposure to cocaine represents the prenatal influence and the first layer of influence over behavior and development. The neonatal dimension is characterized by the newborn's risk of experiencing medically related problems and it is related to the outcome. The postnatal dimension is comprised of the social ecological systems described in Bronfenbrenner's (1979) ecological model of human development. These systems are characterized by the following: (1) the families' sociodemographic background, (2) the families' social support system, (3) the home environment, and (4) the psychosocial status of the primary caregivers.

The data in this research come from a matched-control prospective, longitudinal study on the effects of prenatal cocaine exposure on fetuses, infants, and developing children. The study includes a target group of children whose biological mothers used cocaine during their pregnancy and a control group of children whose biological mothers did not use cocaine during their pregnancy. During the enrollment that began during the pregnancy, for each cocaine user enrolled, a non-cocaine user was enrolled who had similar sociodemographic characteristics and prenatal health risks.

The strengths of the data include the following: (1) the early prenatal enrollment of cocaine users and non-users who were matched on numerous social and physiological

demographics, (2) the repeated drug measures, including oral maternal drug use histories, unexpected urine screenings, and confirmation of cocaine exposure through gas chromatography/mass spectroscopy, and (3) the use of well trained evaluators who did not know the children's cocaine exposure status while conducting the child assessments of behavior and development.

The goal of this research is to examine the problems associated with prenatal cocaine exposure using a multidisciplinary approach and an empirically sound research design that attempts to avoid the pitfalls found in the existing research on the topic of behavior and development of "at-risk" children. The proceeding sections of this report include a summary of the existing literature on prenatal cocaine exposure (chapter 2), an outline of the multidimensional model used to evaluate behavior and development (chapter 3), a detailed description of the research design and sampling procedures (chapter 4) and an analysis of the findings (chapter 5) along with their practical and theoretical implications (chapter 6).

CHAPTER 2
THE STUDY OF PRENATAL COCAINE EXPOSURE

The image of a drug-exposed infant lying in an incubator connected to lifesaving machinery has been reproduced in magazines, newspapers, journals, and on television throughout the 1980s and 1990s. The rising number of pregnant cocaine users giving birth to prenatally exposed infants and the emotions provoked by these media drawn images resulted in the emergence of over 100 scientific studies on the effects of prenatal cocaine exposure on women and children (Lester, LaGasse, and Seifer 1998). Based on my review of the National Institutes of Health's listing of scientific projects, there are over thirty federally funded studies on prenatal cocaine exposure (National Institutes of Health 2001).

In this chapter, I summarize the biomedical, behavioral, and sociological literature on prenatal cocaine exposure. The literature that I review denotes the need for more studies on prenatally cocaine exposed children that take an integrative or multidisciplinary approach. There is an abundance of research on the physiological effects of cocaine on fetuses and newborns and a paucity of research on the social environmental determinants of early childhood development for this group of children.

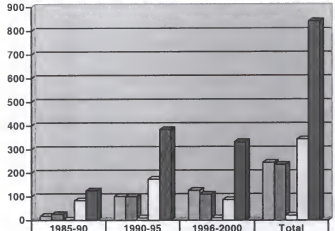
Literature On Prenatal Cocaine Exposure

My review of the literature on prenatal cocaine exposure consisted of a search of library databases using the terms "prenatal cocaine exposure" and/or "cocaine and pregnancy." This search resulted in over 800 articles that I have placed in four

categories: biomedical studies, behavioral (psychological) studies, sociological research, and media generated articles.

I was able to find research articles in (1) Medline, the most popular search engine for medically related scientific research, (2) PsycInfo, a search engine including articles related to psychology and the behavioral sciences, (3) Sociological Abstracts and Sociofile, two search engines dedicated to social science research, and (4) Lexis-Nexis, a search engine that includes international and national newspaper and magazine articles, in addition to other sources of information. Due to the nature of computer databases, the overlap between databases is inevitable. There were articles in Medline that were also available in PsycInfo and research in PsycInfo and Medline that may have been covered by newspapers and magazines listed in Lexis-Nexis, but this does not lessen the point that there were more articles on prenatal cocaine exposure and cocaine use in pregnancy in the biomedical and psychological databases than in the sociological databases.

There were 244 scientific articles in Medline, characterizing a plethora of research in the biomedical field. There were 235 articles posted in PsycInfo compared to only 20 articles (less than 5%) in the sociological databases, Sociological Abstracts and Sociofile. Thus, nearly half of the articles were found in the biomedical and psychologically oriented databases with the remaining 40% (n=343) being media generated articles found in Lexis-Nexis. In the academic disciplines, the number of articles produced between 1985 and the year 2000 increased substantially. Between 1990 and 1995 the media's interest in the topic reached its peak at 174 articles, outnumbering the articles found in Medline (n=101), PsycInfo (n=110), and the sociological databases (n=9). Figure 1 illustrates the distribution of the literature across each area of interest.



	1985-90	1990-95	1996-2000	Total
Medline	17	101	126	244
Psycinfo	25	100	110	235
Socabs	1	9	10	20
Media	83	174	86	343
Total	125	384	332	842

Figure 2.1: Number of Citations per Discipline Per Year

Biomedical Research

When the "crack scare" began in 1985, the majority of research on cocaine exposed newborns focused on the potential neurological and physiological damage caused by the drug using a teratogenic or deficit model approach. Health care providers, researchers, educators, and social servants developed a deep concern for prenatally cocaine exposed children as a consequence of these early reports of severe prenatal and postnatal problems caused by pregnant women's use of crack cocaine. As seen in media reports on the prevalence of the problem, many people also became anxious about the impact prenatally cocaine exposed children would have on our health and social service

systems (Archibald 1992; Bays 1990; Martinez 1995). These concerns resulted in a drastic increase in the number of research studies on the topic. However, many of these studies lacked either an inclusive theoretical perspective or a sound methodological framework (Zuckerman and Frank, 1994).

Early biomedical studies reported problems such as spontaneous abortions (Cherukuri, Minkoff, Feldman, Parekh, and Glass 1988; Lutiger, Graham, Einarson, and Koren 1991; Ryan, Ehrlich, and Finnegan 1987; Wang and Schnoll 1987), premature births (Cherukuri et al. 1988; Rosenak, Diamant, Yaffe, and Hornstein, 1990), low birth weight (Cherukuri et al. 1988; Chouteau, Namerow, and Leppert 1988; Ryan et al. 1987; Zuckerman et al. 1989), and irreversible birth defects (Chavez, Mulinare, and Cordero 1989) in cocaine exposed human newborns. Yet, more recent studies have published contradictory evidence due to differences in their study design and use of different statistical controls.

For example, both Cherukuri et al. (1988) and Chouteau et al. (1988) reported that cocaine use during pregnancy caused low birth weight among exposed infants, but they both did not find similar results when comparing the relationship between prenatal cocaine exposure and spontaneous abortions or premature births. In the Cherukuri et al.(1988) study, which did not control for the use of prenatal care, cocaine exposure was related to preterm births, whereas in the Chouteau et al. (1988) study, which controlled for prenatal care and a variety of social demographic factors, cocaine exposure was not related to pre-term births. According to Chouteau et al. (1988), lack of prenatal care was a significant predictor of this poor health outcome.

The following studies published in the late 1980s also failed to control for social and environmental factors that could substantially influence the study results. In 1989, Zuckerman and his associates reported the findings from a prospective study that included 1226 pregnant women and their newborn infants. In their study on the impact of cocaine exposure on fetal outcomes, the researchers found that when comparing the newborns of women who tested positive for cocaine (n=110) to non-cocaine users (n=1116), the newborns of cocaine users had significantly lower birth weights ($p = 0.07$), a decrement in length ($p = 0.01$), and proportionally smaller head circumferences ($p = 0.01$) than the non-exposed newborns (Zuckerman et al. 1989). Even though the number of the cocaine-exposed infants included in the study was considerably smaller than the non-cocaine exposed infants, the researchers were able to control for a variety of physiological factors in this study; yet, social and environmental factors that can influence neonatal outcomes were not controlled.

Chavez, Mulinare, and Cordero (1989) conducted a retrospective study of congenital anomalies in children born in Atlanta area hospitals between 1968 and 1980. In this study, the researchers report a statistically significant relationship between maternal cocaine use and urinary tract anomalies in infants (crude odds ratio, 4.39; 95% confidence interval, 1.12 to 17.24). However, this study did not control for the social, demographic, or environmental factors that may also relate to poor birth outcomes, such as race, access to prenatal care or socioeconomic status.

Kliegman and associates (1994) conducted a prospective study of the effect of prenatal cocaine exposure on birth weight and prematurity. In the Kliegman (1994) study, of the eleven sociodemographic and physiological variables analyzed, race and

utilization of prenatal care services, along with cocaine, marijuana, and cigarette use, were significantly correlated with poor birth outcomes. Cocaine exposure (odds ratio, 13.4; 95% confidence intervals, 1.23 to 145.0) and prenatal care (odds ratio, 9.89; 95% confidence intervals, 3.74 to 26.17) were significant predictors of low birth weight and premature births, demonstrating a need to assess the long-term effects of these variables on developmental outcomes.

Most studies concur that prenatal cocaine exposure results in low birth weight and prematurity, but there are also other factors, like the lack of prenatal care, race, and overall maternal health, that are related to these poor health outcomes. In 1997, Lester and his associates constructed a database of studies on prenatal cocaine exposure (Lester, LaGasse, and Brunner 1997). The 76 studies included in the final database (1) pertained to cocaine use during pregnancy, (2) were based on original research using human subjects, (3) included neurobehavioral measures, (4) included control or comparison groups, (5) analyzed the data statistically, and (6) were found in peer reviewed or refereed publications.

The analysis of the articles included in the database lead Lester and his colleagues to contend that the neurodevelopmental disorders identified in infants participating in the studies on prenatal cocaine exposure could be attributed only partially to the presumed neurological damage caused by drugs. Lester et al. (1997:487) writes:

> The data base shows that our knowledge base is limited, scattered, and compromised by methodological problems that mitigate any conclusions about whether or not or how prenatal cocaine exposure affects child outcome. Only a few studies have followed children beyond age 3. In addition, the cocaine problem is more complicated than first envisioned. It is a multifactorial problem including the use of other drugs and parenting and environmental lifestyle issues.

Lester and his colleagues (1996, 1997) along with other behavioral researchers (Graham and Koren 1991) have suggested that there are social, environmental, and other medical conditions that may contribute to the poor health outcomes of prenatally exposed children, but as indicated by my review of the literature and Lester's database, very little of the research conducted by natural scientists address social concerns. Of the articles I reviewed, none of the biomedical studies were initially designed to address the social and environmental concerns that many behavioral and social science researchers deem important.

Behavioral (Psychological) Studies

The psychological and behavioral research that addresses the social and environmental conditions affecting the development of prenatally exposed newborns has helped shift the focus from the biomedical to the social and environmental. Many of the psychologically oriented studies of prenatal cocaine exposure focus on how cocaine exposure influences the behavioral development of newborns and young children. This differs from the biomedical focus on the effects of cocaine on human physiology and subsequent health outcomes. The behavioral studies also tend to include more psychosocial controls, thus providing further explanation of the differences or lack of differences between children who have been prenatally exposed to cocaine and non-cocaine exposed children.

For example, Woods and associates conducted a study of the effect of cocaine exposure and maternal affect on the neurobehavioral development of neonates (Woods, Eyler, Behnke, and Conlon 1993). This study included maternal depression and prenatal care as psychosocial controls. In this well-controlled and methodologically sound study, the researchers did not find any significant differences in the neurobehavioral

development of one-month old infants who were and who were not exposed to cocaine prenatally. This study from the larger research project from which I am drawing my data, employed a theoretical framework that acknowledged the importance of psychosocial factors, while using a sound quasi-experimental design.

Many of the studies found under the behavioral or psychological rubric have employed similar experimental designs that are intended to control for physiological and environmental factors that may influence the results. Some of the researchers have acknowledged the influence that the social environment has on developmental outcomes (Bendersky and Lewis 1998; Grant, Bendersky, and Lewis 2000; Alessandri, Bendersky, and Lewis 1998), but there are still many studies that lack sound methodological guidelines making it difficult to present conclusive results.

In a recent article by Singer (1999) titled "Advances and Redirections in Understanding Effects of Fetal Drug Exposure," the author calls for researchers to use more "rigor" in their methodological designs, to improve "quantifiable and self report measures," and to use more "sensitive" statistical models. These comments are a response to the inconclusiveness of the existing research on children who have been prenatally exposed to a variety of drugs, including cocaine.

Many biological and behavioral researchers have been unable to conclusively state that cocaine use during pregnancy directly impacts later behavior in the pre-exposed child. The studies that have been published utilize longitudinal, cross-sectional, retrospective, prospective, and case controlled research designs and they vary in how prenatal cocaine use is measured, defined, and analyzed (Mayes, Granger, Bornstein, and Zuckerman 1992). The inconsistency in research methodologies makes it very difficult

to summarize the research findings pertaining to the effect of prenatal cocaine exposure on behavior and development from a biomedical or a behavioral perspective. Linda Mayes' (1996) review of the literature found that most studies dealing with behavioral and developmental problems among cocaine exposed children were plagued with methodological problems, such as poor population sampling, issues of polydrug use, lack of longitudinal data, and lack of environmental controls.

For example, the variability in research designs has lead to contradictory results in several behavioral and developmental studies. In an article written by Angelilli and associates (1994), it is stated that children with a detected language delay are more likely to have been prenatally exposed to cocaine than children with normal language development. However, this finding is based on a study of language delay in which 29 children with delays were compared to children with no delays and prenatal drug use was collected retrospectively from the child's caregiver during the child's clinical appointment. The researchers found prenatal cocaine and nicotine exposure to be significantly correlated with language delays among children aged 24 to 48 months. The research design does not allow for adequate controls nor does it verify the nature of the cocaine exposure.

In a prospective longitudinal study of prenatal cocaine exposure with masked evaluators conducted by Hurt and her colleagues (1997), the researchers did not find any relationship between poor language development and prenatal cocaine exposure among their matched sample of prenatally cocaine and non-cocaine exposed subjects at 30 months of age using the Preschool Language Scale. However, in a different study, Johnson and his peers (1997) found significant differences in language ability and

development skills between prenatally cocaine exposed and non-exposed children between 11 and 50 months using the Sequenced Inventory of Communicative Development-Revised and the Bayley Scales of Infant Development. This study included a matched sample of children who had been living in stable, drug free environments at the time of the testing.

Eyler and Behnke (1999) created a comprehensive review of the literature on prenatal cocaine exposure's influence on early development. Like Mayes (1996), Eyler and Behnke also comment on the variability in methodologies that make it difficult to make conclusive statements about cocaine's influence on early childhood development. According to Eyler and Behnke (1999), approximately one third of the neonatal studies they reviewed found that prenatal cocaine exposure did not influence behavioral development. The most commonly reported findings were poorer state and autonomic regulation, irritability, and decreased alertness and orientation among cocaine exposed neonates. In studies of three to twenty-four month old infants, about half found no differences between prenatally cocaine exposed and non-exposed infants in development or adaptive behavior. According to Eyler and Behnke (1999), other studies found that prenatally cocaine exposed children experienced problems with arousal and responsiveness, visual expectancy, recognition memory, information processing, and attachment and play during the first year of life.

Singer (1999) proposes more systematic questioning and longitudinal research as a means of determining the long-term effects of cocaine on behavior, while I propose different questions and more sociological research as a means of increasing our

understanding of the relationship between prenatal cocaine exposure and childhood outcomes.

Sociological Studies

In my review of the literature, I was able to identify only 20 studies on "prenatal cocaine exposure" and/or "cocaine and pregnancy" in the sociology databases. Only four of these articles pertained to prenatally cocaine exposed infants. The majority of the articles were about drug use among pregnant women (Bendersky, Alessandri, Gilbert, and Lewis 1996; Choe, Murphy, and Murphy 1998; Higgs 1996; Humphries 1998; Humphries, Dawson, Cronin, Keating, Wisniewski, and Eichfeld 1992; Kearney and Murphy 1993; Kearney, Murphy and Rosenbaum 1994; Lanehart, Clark, Kratochvil, Plings, and Fidora 1994; Maher 1990; Murphy and Ferreboeuf 1997; Pursley-Crotteau and Stern 1996; Singer, Arendt, Minnes, Farkas, Yamashita, and Kliegman 1995; Smith, Dent, Coles, and Falek 1992; Teagle and Brandis 1998). The articles that dealt with prenatally cocaine exposed infants addressed issues of care-giving (Franck 1996; Hamid 1994), the protection of prenatally exposed infants (Besharov 1989), and the problems these children present to society (Best 1994). Unlike the biomedical and behavioral studies, these studies did not focus on the effect prenatal cocaine exposure has on the developing child, but rather the impact prenatally exposed children have on the world in which they live.

There are numerous methodological and theoretical gaps within the sociological literature, given the limited number of articles and their limited scope. There are studies that address social issues, such as the relationship between prenatal cocaine exposure and the parenting, home, and community environments, but these were not found within the sociological databases used in this literature review, because these studies lacked a clear

sociological perspective. Therefore, my research is intended to fill the gap by conducting research on prenatal cocaine exposure from a viewpoint that is not only sociological, but multidimensional in nature as well.

In any research that depends on the study of human subjects within their social environment, it is very difficult to maintain a strict disciplinary focus while conducting research that requires a rigorous experimental design. Human subjects are difficult to study because what happens in the course of the human subjects' life when outside of a laboratory is impossible to control. Unlike rats used in experimental research, it is nearly impossible and in virtually all cases unethical to place humans in a box or a controlled environment for a prolonged period of time to analyze their behavior while exposing them to a lethal substance, such as cocaine. Social science researchers can benefit from the methods used by behavioral scientists, and biomedical scientists can benefit from the social context incorporated into research studies by social scientists. Hence, a multidimensional integrative approach needs to be employed.

Conclusion

The study of the effect of prenatal cocaine exposure and the social environment on the behavior and development of children requires a research design that incorporates the methodological strengths found in experimental research and a theoretical framework that allows one to examine numerous levels of influence on an outcome. This is why I advocate the use of a conceptual model that integrates social, behavioral, and biomedical methodologies and theoretical perspectives. Despite the contributions biomedical, behavior, and social science researchers have made to the literature on the impact of

prenatal cocaine exposure on the developing fetus and infant, there is still a knowledge gap to fill.

Since the mid-1980s, numerous biomedical studies[1] (Azuma and Chasnoff 1993; Bellini, Massocco, and Serra 2000; Chiriboga, Brust, Bateman, and Hauser 1999; Fantel and Macphail 1982; Garavan, Morgan, Mactutus, Levitsky, Booze, and Strupp 2000; Roland and Volpe 1989; Volpe 1992; Vorhees 1995; Zuckerman 1985), behavioral studies (Alessandri, Sullivan, Bendersky, and Lewis 1995; Eyler and Behnke 1999; Leech, Richardson, Goldschmidt, and Day 1999; Lester, Corwin, Sepkoski, Seifer, Peucker, McLaughlin, and Golub 1991; Richardson, Hamel, Goldschmidt, and Day 1996) and development studies (Arendt, Singer, Angelopoulos, Bass-Busdiecker, and Mascia 1998; Coles and Platzman 1993) have reported on the negative effects of cocaine on fetal, neurological, physiological, cognitive, and behavioral outcomes. However, with the exception of a few recent studies and reviews (Hubbard 1998; Inciardi, Surratt, and Saum 1997; Mayes 1992; Smith 1992), very little sociological or multidisciplinary research has been done on children who have been prenatally exposed to cocaine. Incorporating a multidisciplinary perspective will help further our empirical understanding of the social, structural, environmental, and psychosocial factors that shape children's development and that influences their behavior.

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[1] The included references exemplify studies published and cited repeatedly over the past twenty years. In no way is it an exhaustive list of all the research produced on prenatal cocaine exposure.

CHAPTER 2
MULTIDIMENSIONAL MODEL

The plethora of contradictory and inconclusive findings in the biomedical and behavioral science literature on the effects of prenatal cocaine exposure is demonstrative of how the existing knowledge gaps are best filled by a multidimensional approach. In this study, I apply a multidimensional approach that integrates biomedical, behavioral and sociological principles. This theoretical process is consistent with the vision of the new social and behavioral health science research taking place at the national level (Singer & Ryff 2001). The multidimensional model that I have conceptualized is heavily influenced by the research agenda established by the Office of Behavioral and Social Science Research (OBSSR) at the National Institutes of Health (NIH). The OBSSR agenda prioritizes the study of "biological, behavioral, psychological, and social precursors to disease" and "biological, behavioral, and psychosocial factors that contribute to resilience, disease, resistance, and wellness" (Singer and Ryff 2001: 3).

In this chapter, I outline the multidimensional model and how it will be applied to the study of the behavior and development of prenatally cocaine exposed children. I begin by providing a brief background of the sociological perspective, in order to provide a foundation for the multidimensional model that bridges the gap between the social, behavioral, and biomedical disciplines. Then I proceed by defining behavior and

development and the rationale for studying pre-school aged children. The chapter ends with a restatement of the research questions and general hypotheses.

Sociological Perspective

From a sociological perspective, the study of behavior and development typically involves the study of human interaction and the relationships that evolve from that interaction. These relationships are manifested in the form of social roles, norms and groups that dictate human behavior and can influence human development. In sociology, behavior is more or less viewed in terms of social action or performance and development is seen within the context of the life course. Micro-sociological theories, such as symbolic interaction, focus on the factors that drive social performance or action (Berger & Luckmann 1966), while macro-sociological theories, like the life course perspective, focus on how larger social forces or period events impact society over time (Elder 1995).

This study incorporates both micro and macro level concepts. These concepts facilitate our understanding of how micro level constructs (such as maternal drug use and/or parent-child interaction) interact with macro constructs (like social and economic demographics) to predict outcomes for children whose lives have been effected by the physiological and social consequences of prenatal cocaine exposure. The use of multiple dimensions to create a more complex understanding of social life and social structures is the foundation of sociology as a discipline (Parsons 1951). Sociology is not simply the study of society, but the study of relationships between multiple dimensions of society, including biomedical, behavioral, and social factors.

Talcott Parsons (1982), a leader in the field argues that sociology should be driven by analytical theories that:

- help the researcher determine which factors are important and which ones are not important to the research;
- provide a basis for organization of the factors included in the analysis;
- help uncover the existing knowledge gaps that need to be filled; and
- allow for the integration of theories from related disciplines.

The multidimensional approach that drives this research attempts to do these four things by examining the existing research and integrating theory. The review of the literature on prenatal cocaine exposure helped me to identify what factors should be included in the multidimensional model and how they should be organized. Plus, the literature review allowed me to uncover the existing knowledge gaps, in particular the lack of an integrative approach and the need for more research on pre-school aged children's behavior and development. Therefore, my research integrates micro and macro level constructs from a variety of disciplines as a means of constructing a multidimensional model of the behavior and development of prenatally cocaine exposed children.

Components of the Multidimensional Model

I have constructed a multidimensional model of behavior and development that integrates the biomedical, behavioral, and social sciences. As exhibited in the previous chapter, the research conducted by biomedical, behavioral and some sociological researchers present contradictory results on the effects of prenatal cocaine exposure on the developing child. There is some evidence that prenatal cocaine exposure is significantly correlated with fetal brain disruption (Bellini 2000), low birth weight (Cherukuri et al. 1988; Chouteau et al. 1988; Ryan et al. 1987; Zuckerman et al.1989)

and premature births (Cherukuri et al. 1988). Several behavioral research studies have revealed that prenatal cocaine exposure is related to poor motor development (Arendt, Angelopoulos, Salvartor, and Singer 1999), cognitive development (Alessandri et al.1998; Arendt et al 1998), and language development (Angelilli, Fischer, Delaney-Black, Rubinstein, Ager, and Sokol 1994; Johnson, Seikel, Madison, Foose, & Rinard 1997), yet the sociological literature (or lack there of) reminds us that there are still a lot of unanswered questions about the relationship between the prenatal and postnatal influences on developmental and behavioral outcomes for these "at-risk" children.

I intend to employ a sociological perspective to examine not only how prenatal cocaine exposure relates to two particular outcomes, but I will examine how prenatal cocaine exposure impacts these outcomes when it is included in a conceptual model that includes neonatal and postnatal factors. The conceptual model of behavior and development presupposes that prenatal and neonatal physiological factors and postnatal behavioral and social environmental factors each play a role in determining the behavior and development of prenatally cocaine exposed children as they age. This multidimensional approach provides a consummate strategy for studying such a complex problem.

The multidimensional model I have created combines the tenets of sociology, ecology, psychology, and biomedicine by defining social action, the sociological concept, as the biological mother's use of cocaine during pregnancy and by using biomedical, behavioral, and sociological constructs to describe the biomedical and social ecological factors included in the model. The prenatal and neonatal dimensions represent the biomedical factors and the social ecological factors represent the postnatal dimension.

The neonatal and postnatal factors help mediate the effect of the prenatal dimension on behavior and development, two psychologically oriented constructs.

Prenatal Dimension

First, the negative effect of cocaine could be a result of the physiological impact cocaine has on the developing fetus or it could be due to the fact that many children born to cocaine using mothers are at a greater risk of reaping the negative social consequences of their mother's cocaine habit. These consequences include biomedical and sociological risk such as, lack of proper health care and nutrition, exposure to numerous drugs during and post pregnancy, the risk for physical and emotional abuse, poverty, high residential mobility, and poor or limited parent child interaction due to incarceration, limited sobriety, or the termination of parental rights because of the mother's drug use. Therefore, regardless of whether or not prenatal cocaine exposure has a physiological or sociological effect on children, it is a significant predictor in the multidimensional model of behavior and development.

Neonatal Dimension

The second factor included in the model is the measure of the neonatal environment. The neonatal environment is characterized by the child's health status at birth. According to the biomedical model, the complications encountered during pregnancy and during labor and delivery are indicative of a child's risk for future health related problems (Hobel, Youkeles, & Forsythe 1979); therefore, it is an important variable in the multidimensional model of adaptive behavior and development. Simply evaluating the relationship between the neonatal environment (prenatal cocaine exposure) and behavior and development, negates the role that neonatal risk factors and postnatal social factors play in determining a child's outcomes.

Postnatal Dimension

The social environment, which characterizes the postnatal environment is the third dimension in the multidimensional model. The potential social influences on behavior and development are numerous. Bronfenbrenner's social ecological model serves to organize the most salient factors, including the caregiver, home, family, and social structural variables. Each of these variables represent what Bronfenbrenner calls the micro-, meso-, exo-, and macrosystems in his ecological model of human development (Bronfenbrenner 1979).

Theoretical Framework

Social Ecological Theory

Bronfenbrenner's (1979) ecological model of human development provides a foundation for describing the relationship between multiple factors and their influence on an outcome. Using the principles of systems theory, Bronfenbrenner's (1979) ecological approach describes how a series of environmental systems create dimensions of influence on human development and ultimately behavior. In his book, The Ecology of Human Development, Bronfenbrenner defines the ecology of human development as such:

> The ecology of human development involves the scientific study of the progressive, mutual accommodation between an active, growing human being and the changing properties of the immediate settings in which the developing person lives . . . (Bronfenbrenner 1979: 21).

In other words, ecology is the study of humans and their relationship to the environment in which they live. The definition offered by Bronfenbrenner reminds social scientists that the relationship that is being observed is not static, but dynamic and it is subject to change as human and environmental properties change.

Bronfenbrenner goes on to state: " . . . this process is affected by relations between settings, and by the larger contexts in which the settings are embedded" (Bronfenbrenner 1979: 21). He describes the observed relationship between humans and their environment as a system that is embedded within other systems similar to a set of Russian dolls. The smallest doll represents the most immediate setting or the microsystem. The microsystem is encompassed by the mesosystem proceeded by the exosystem. Last, the entire system is influenced individually and collectively by the macrosystem reflecting a higher level of influence, such as culture or subculture (Bronfenbrenner 1979).

The microsystem has been defined as the psychosocial status of the child's primary caregiver. According to child development theorists, there is a direct relationship between parental attitudes and behaviors and children's outcomes (Cochran and Brassard 1979). Additionally, Zuckerman and his associates (1990) found a significant relationship between early childhood problems and maternal depression even when controlling for cocaine exposure status. Bronfenbrenner (1979) refers to this relationship between parents and their children as a dyadic relationship that functions in a reciprocal fashion.

For instance, a mother who experiences depression may be less responsive to her child's needs resulting in poor behavioral outcomes for the child. Reciprocally, a child who presents numerous behavioral and developmental problems may contribute to increased feelings of helplessness and depression for the mother. Researchers have found that maternal depression is related to poor child rearing practices (Coletta 1983) and that poor parental efficacy is correlated with poor behavioral outcomes for children (Johnston

and Mash 1989). Hence, the psychosocial status of the primary caregiver is included in the postnatal factor of the multidimensional model as a means of assessing its relationship to behavior and development.

The mesosystem is defined as the nature and quality of the child's home environment. Like the microsystem, the mesosystem is presumed to influence behavior and development. Studies on the home environment have shown that children who live in stimulating and loving environments can overcome numerous obstacles, such as developmental delays caused by poor neonatal health outcomes (Mayes 1996), foster care placement (Horwitz, Simms, and Farrington 1994), parental divorce, and poverty (Miller & Davis 1997). According to Bronfenbrenner (1979), children's developmental potential is enhanced when their physical and social environment enables them to participate in a variety of activities.

The family's social support mechanism reflects the exosystem and the families' sociodemographic characteristics comprise the macrosystem in the postnatal environmental factor. Bronfenbrenner's ecological model of human development clearly states that the relationship between the family and its support mechanisms and the family's access to support mechanisms is a critical part of human development; hence these are essential parts of the multidimensional model that has been constructed to evaluate the behavior and development of the children in this study. According to Bronfenbrenner (1979: 7):

> . . .whether parents can perform effectively in their child-rearing roles within the family depends on role demands, stresses, and supports emanating from other settings. As we shall see, parents' evaluations of their own capacity to function, as well as their view of their child, are related to such external factors such as flexibility of job schedules, adequacy of child care arrangements, the presence of friends and

neighbors who can help in large and small emergencies, the quality of health and social services, and neighborhood safety.

The factors that characterize the exosystem and the macrosystem are related to parental behavior, which in turn is related to childhood behavioral and developmental outcomes. Parents who have a greater sense of family and social support will experience less stress, thus enhancing their relationship with their children. The improved relationship between parent and child leads to improved behavioral development (Cochran and Brassard 1979; Dunst and Trivette 1986; Johnston and Mash 1989).

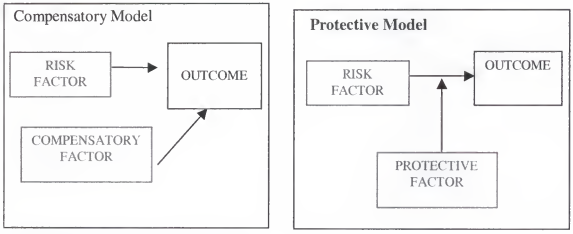
Additionally, the social and economic factors that characterize the macrosystem serve as proxies for the availability of flexible job schedules, the quality of care, and the relative safety of the neighborhood. These factors in the postnatal environment also have an effect on parental behavior; thus having an impact on childhood outcomes. Families who have limited economic resources are more likely to have less flexible jobs, poorer quality health care, and to live in economically disadvantaged neighborhoods plagued by crime and other safety hazards.

The prenatal, neonatal and postnatal dimensions of the multidimensional model were determined by integrating biomedical, behavioral, and sociological theories, as encouraged by Talcott Parson's (1982), who called for sociologists to integrate theories from a multitude of disciplines. He also argued that sociology should be driven by analytical theories that provide a basis for how the factors in a model are organized. I have organized the multidimensional model using the compensatory model of resilience introduced by Zimmerman and Arunkumar (1994). The prenatal environment represents the biomedical risk to early childhood outcomes while the neonatal and postnatal biomedical, behavioral, and sociological factors compensate for the impact of the

prenatal risk. It is presumed that the positive attributes found in the neonatal and postnatal environments will contribute to the resiliency of "at-risk" children.

Resiliency Theory

Resiliency theory is useful in understanding individual development and behavior (O'Connor and Rutter 1996; Rutter 1989). According to resiliency theorists, there are two central theorems that illustrate the concept of resilience, the compensatory and the protective models (see Figure 3.2). Traditionally, resiliency is defined as the ability to recover after experiencing some type of distress or misfortune. This distress is referred to as a risk factor in resiliency models. Resiliency researchers strive to identify the factors that either compensate for the distress (compensatory model) or that protect individuals from the distress (protective model) resulting in positive outcomes (Davis 1999; Zimmerman and Arunkumar 1994).



Source: Zimmerman and Arunkumar (1994)

Figure 3.1: Compensatory and Protective Models of Resilience

According to the compensatory model, the compensatory factor mediates the effects of the risk factor by providing additional support or strength. Both factors directly influence

the outcome. This differs from the protective model, in that the risk and the protective factors interact with one another to influence the outcome. In the protective model, the protective factor intervenes by reducing or eliminating the risk factor.

In this study, I hypothesize that the observed outcomes, behavior and development, are directly influenced by two compensatory factors, neonatal risk and the postnatal social ecological system. In the multidimensional model, I propose that prenatal cocaine exposure is directly related to the behavior and development of pre-school aged children, but I also propose that it is not the only factor that has an impact on the outcome.

As shown in Figure 3.2, the compensatory factors play a significant role as well. I contend that the compensatory factors are directly related to behavior and development. This theory is driven by my belief that the neonatal and postnatal environments do not intervene as the protective model presumes, but these biomedical and sociological factors, actually compensate for the prenatal risk in an additive fashion. Prenatal cocaine exposure, neonatal health status, and the postnatal social ecological factors each play a part in determining the behavior and development of pre-school aged children. Therefore, prenatally cocaine exposed children may be able to overcome the risk associated with prenatal cocaine exposure when the neonatal risk is reduced and the postnatal environment is optimized.

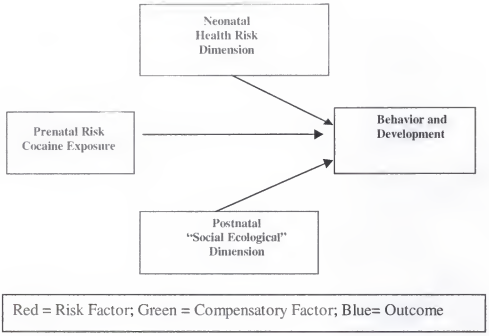


Figure 3. 2: Multidimensional Model of Behavior and Development

Definitions Of Behavior And Development

Behavior and development can refer to many different constructs and both terms have been defined and measured in different ways. In this research, I define and measure behavior and development separately. The term behavior actually refers to the children's adaptive behavior or their ability to demonstrate the skills and perform the tasks that are expected of them as they reach maturity. Behavior reflects the acquisition of the necessary skills for taking care of oneself and getting along with others (Vineland 1984). The study of adaptive behavior among prenatally cocaine exposed children is important because it serves as a proxy for the child's ability to survive in a complex world that requires independence, as well as social cooperation or the ability to conform to social norms.

Development refers to the achievement of particular growth parameters in relation to chronological age. The typical measures of development include abstract reasoning, memory, learning, and problem-solving abilities and fine and gross motor skill development. These skills play an important role in a child's ability to orient towards the environment and they influence the quality of the child's interaction with the environment (Bayley 1969). In this study, development and behavior are measured independently, but they are presumed to follow the same pathways. Some developmental scientists would argue that the behavior and development are inextricably intertwined (*see* Bergman, Cairns, Nilsson, & Nystedt 2000; Bijou and Ribes 1996; Immelmann, Barlow, Pterinovich, & Main 1981; Pujol, Vendrell, Junque, Marti-Vilalta, & Capdevila 1993 *for discussions on behavior development*); hence, the application of one model for both constructs.

Reason for Studying Pre-Schoolers

Half of the children included in this study of adaptive behavior and development have been prenatally exposed to cocaine and the other half have not been exposed to cocaine prenatally, but both groups can be defined as "at risk" of poor behavioral and developmental outcomes. The majority of the sample is comprised of Black children born of relatively inexperienced and poorly educated mothers. By age three, many of the children are living with primary caregivers who are at-risk of depression and who have household incomes below the poverty line.

Thirty-six months is a prime age to observe the behavior and development of these "at-risk" children, because as children reach the age of three, they are expected to perform tasks and acquire skills that are not easily measured or observed during earlier ages. According to the American Academy of Pediatrics, three-year old children are

increasingly social and inquisitive, thus enhancing their independence, which is marked by their attempts at communication and mobility (Cowley 2000; Kantrowitz 2000; Raymond 2000). The acquisition of social, communication, daily living, mental and motor skills are important to the child's overall growth and development; however for many poor, Black children their growth and development is thwarted by their impoverished social and economic status (Brooks-Gunn & Duncan, 1997; McLeod & Nonnemaker, 2000; McLoyd, 1990).

Studying behavior and development at age three makes methodological sense because, most children have not entered a formal educational institution; therefore, the influences on their behavior and development are considerably less than school age children. Even though three-years is a relatively short period of time given the typical age of mortality in the United States, three-year olds do have a life course trajectory. According to the multidimensional model, their prenatal, neonatal, and postnatal environments reflect a trajectory that impacts their behavior and their development as they mature. Each environmental dimension represents a particular level of influence in the multidimensional model. The neonatal and postnatal environments represent levels of influence that compensate for the risk associated with a harmful prenatal event, specifically prenatal drug exposure.

Research Questions

The conceptual model outlined in this chapter will be used to answer the following questions:

> How do prenatally and non-prenatally cocaine exposed children differ on measures of behavior and development at age three?

> To what extent do prenatal, neonatal and postnatal factors, including prenatal cocaine exposure, neonatal health and the postnatal social ecological factors, enhance or hinder pre-school age children's behavior and development?

I expect that when controlling for the neonatal and postnatal factors, the impact of prenatal cocaine exposure on the behavior and development of pre-school aged children will be reduced. Previous researchers have found significant differences between prenatally and non-prenatally cocaine exposed infants, whereas the exposed infants are at a greater risk of experiencing poor outcomes. But does the effect of prenatal cocaine exposure persist beyond infancy and into early childhood? And if so, can these effects be compensated for when the child has minimal health problems and resides within a positive social ecological setting? The anticipated answers to these questions are outlined in the next chapter, which also includes a detailed description of the research methods, the hypotheses and how they are operationalized.

CHAPTER 3
RESEARCH VARIABLES AND SAMPLE DESCRIPTION

Designing a quality study involves constructing a research protocol that contains valid and reliable measures of the variables outlined in the theoretical model. This helps to minimize the bias that results from poorly designed studies. After creating the conceptual framework outlined in the previous chapter, I was fortunate enough to find a source of data that contained the variables necessary to address the questions posed in the previous chapter. In addition to the data source being comprehensive, the procedures used to collect the data are empirically reliable and valid to the extent that researchers are able to depend on the honesty and integrity of human subjects. In this chapter, I describe the data collection techniques, the longitudinal sample, and the operationalization of the prenatal, neonatal, and postnatal factors in the multidimensional model.

Data Collection

The data used in this study comes from a cross-section of the data collected for a longitudinal study on cocaine use among pregnant women conducted in the Department of Pediatrics at a university hospital in the southeastern region of the United States. From 1991 to 2001, data were collected from study participants during their pregnancy, at the birth of the target child, and during scheduled follow-ups with the target child and his or her respective primary caregiver. The data used in this study come from the follow up interviews and assessments conducted when the target child reached 3 years of age.

This study uses a quasi-experimental design to assess the adaptive behavior and development of children who have been prenatally exposed to cocaine by comparing them to a group of matched controls. The recruitment procedures were based on a matched group design in order to minimize the effects of possible confounding variables, such as socioeconomic status, race, parity, and level of prenatal risk (Behnke, Eyler, Woods, Wobie, and Conlon 1997).

Recruitment took place between 1991 and 1993 at the recruitment hospital or at one of its surrounding prenatal clinics. The researchers approached a total of 2,526 potential participants during their first or subsequent prenatal visit or at delivery in order to include a full range of pregnant cocaine users. Only women less than eighteen years of age, who did not speak English, who used an illicit drug other than cocaine and marijuana and/or confounding prescription medications, and those who were diagnosed with a non-drug related chronic illness known to effect pregnancy outcomes were excluded (e.g. diabetes, sickle cell). Of the 2,526 women recruited, 85% (n~2147) consented to participate in the study upon first approach. Upon consent, each woman was given a urine drug screen and a drug history interview.

A power analysis was conducted to determine the necessary sample size in order to maintain statistical power of $p = 0.05$ and to detect an effect size within one-third of a standard deviation on developmental outcomes (i.e. the Bayley Scales for Infant Development). Based on the results of the power analysis it was determined that an enrollment of 150 cocaine users and 150 matched controls would be sufficient assuming an attrition rate of 33% over three years (Eyler, Behnke, Conlon, Woods, and Wobie 1998). Hence, the first 179 women with positive drug screens and/or admitted cocaine

use at the time of delivery were asked to continue their participation in the study. Of these women 154 consented, fit the inclusion criteria and were positively identified as prenatal cocaine users based on their positive urine drug screen given on the day of enrollment and at delivery. One hundred and fifty-four women with negative drug screens and no admission of drug use were enrolled in the control group using the matching criteria.

Urine specimens for the mother and infant were tested using fluorescence polarization immunoassay. Positive screens were confirmed through the use of gas chromatography-mass spectroscopy. This process involves the use of a magnetic device and computer technology to isolate the ionic components of the substance being tested. The use of two drug screens and detailed drug histories were employed to minimize the chances of misclassification of drug users as non-drug users (Behnke, Eyler, Woods, Wobie, and Conlon 1997). These methods of classification are highly regarded by researchers in the field (Arendt, Singer, Minnes, and Salvator 1999). The University's Institutional Review Board approved all methods and procedures and great care was taken to assure that each participant understood what she was agreeing to when signing the informed consent and to protect the confidentiality of all participants.

Description of Longitudinal Sample and Sample Retention

Description Of Birth Mothers

At birth the total sample included 154 cocaine users and 154 non-cocaine users. Each woman was interviewed prior to the birth of the target child and/or immediately after the child was born. When possible each woman was first interviewed during her initial entry into the health care system and during each subsequent trimester to facilitate

her recent recollection of drug use and other life events. Forty-one percent began their interviews during the first trimester, 34% during the second trimester and 25% of the women did not receive their first interview until delivery as a result of when the subject entered the health care system. The women enrolled at delivery received limited or no prenatal care. Women who were trained to establish rapport conducted the prenatal interviews. The interviewers were instructed to appear non-judgmental, supportive, and encouraging. This enhanced the reliability of the information collected.

The group of cocaine users is not significantly different from the non-cocaine users on any of the matching criteria. The two groups were matched on race, socioeconomic status, parity, and perinatal risks. On average, the cocaine users were older than the non-users by 3 to 4 years, yet both groups fell within the same age range of 18-43 with only two women (one in each group) over the age of 40 years. The majority of the cocaine users were Black (n=125). The majority of the cocaine users were classified as unskilled laborers as determined by the Hollingshead Index (Hollingshead 1975) and the majority had received 12 years or less of formal education. The cocaine users and non-cocaine users reported some alcohol, marijuana, and tobacco use with the cocaine users reporting significantly higher usage rates on all substances. Forty-two percent of the sample reported never being married. Additionally, 134 of the cocaine users reported having previous births; hence they were matched with multiparous non-cocaine users. Table 4.1 provides a description of the biological mothers. Non-parametric statistical procedures were used to calculate the mean differences between the two groups. Each table reports the mean differences, the mean rank, and the Mann-Whitney p-value.

Table 4. 1: Descriptive Statistics of Biological Mother and Child at Birth by Cocaine Exposure Status, Means +/- Standard Deviations (Mean Rank)

	Non-Cocaine Exposed n=154	Cocaine Exposed n=154	Total Sample N=308	Mann-Whitney Test p-values
Age in Years	23.8 +/- 5.5	27.6 +/-4.8	25.8	<0.001
Years of Education Completed	11.4+/-1.1 (157.72)	11.2 +/-1.5 (150.25)	11.3 +/-1.29	0.440
Race = Black	0.81 (154.50)	0.81 (154.50)	0.81+/-0.39	1.000
Symptoms of Depression (CES-D)	23.5	29.7	26.6	<0.001
Socioeconomic Status				
Professional (1)	0	0	0	
Mid-level Prof (2)	1 (0.7%)	1 (0.7%)	2 (0.6%)	0.994 [a]
Skilled Worker (3)	3 (2.1%)	3 (2.1%)	6 (1.9%)	
Semi-skilled (4)	29 (20.1%)	31 (21.5%)	60 (19.5%)	
Unskilled (5)	111 (77.1%)	109 (75.7%)	220 (71.4%)	
Missing values	10	10	20 (6.5%)	

[a] Chi-Square Test

Characteristics Of Children At Birth

Within the longitudinal sample of 308, there were several differences between the prenatally cocaine exposed and non-exposed children's birth outcomes. There were three fetal deaths among the women who used cocaine in utero and one death in the control group; however, the difference was not statistically significant ($p = 0.62$). As shown in Table 4.2, the women who used cocaine in utero were twice as likely to have a premature birth.

Table 4. 2: Longitudinal Study Sample Birth Outcomes by Cocaine Exposure Status, Means +/- Standard Deviations (Mean Rank)

	Non-Cocaine Exposed	Cocaine Exposed	Total Sample	Mann-Whitney Test p-values
Infant's Gender = Female	n=154 0.45 (146.29)	n=154 0.55 (161.76)	N=308 0.47+/-0.50	0.077
Premature Infant = Yes	n=154 .09 (114.83)	n=154 .19 (120.26)	N=308 .14+/-0.35	0.014
Infant's Birth Weight	n=153 3179.4+/-699.6 (166.1)	N=149 2984.9+/-668.2 (136.5)	n=302° 3083.4+/-690.0	0.003
Hobel Risk Score	n=151	N=148	n=299°	
Prenatal	43.0 +/-19.3 (124.47)	54.9 +/-20.6 (176.04)	48.9+/-20.8	<0.001
Labor & Delivery	18.9 +/17.2 (148.63)	18.1 +/14.1 (151.40)	18.6 +/-15.7	0.780
Neonatal	16.6 +/-36.2 (142.64)	21.6 +/-61.5 (157.51)	19.1 +/-50.3	0.135

°The missing values are attributed to fetal death and missed assessments for children born outside of the hospital.

Nineteen percent (n=29) of the prenatally cocaine exposed neonates were born prematurely compared to 9% (n=14) of the non-prenatally cocaine exposed neonates. This difference is statistically significant at p=0.014.

Also, there is a statistically significant difference between the prenatally cocaine exposed children and non-prenatally cocaine exposed children's mean birth weight (p = 0.003). On average the birth weight of the PCE children is lower (mean = 2984 grams; standard deviation = 668) than the non-PCE (mean = 3179 grams; standard deviation =

670). Newborns who weigh less than 2500 grams at birth are considered low birth weight, placing them at risk for physical and developmental complications and even death. Twenty-two percent (n=33) of the PCE children weighed less than 2500 grams at birth compared to 11.8% (n=18) of the non-PCE children. As shown in Figure 4.1, the percentage of low birth weight babies in this sample is considerably higher than the 1994 national average of 7.3%, 13.0% for Blacks, and 6.2% for whites (Ventura 1994).

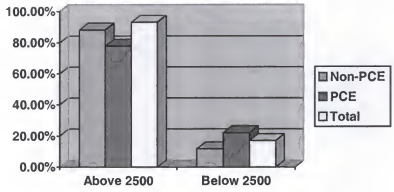


Figure 4. 1: Percent of Low Birth Weight Children by Prenatal Cocaine Exposure Status, n=302

Even though there were differences in the average birth weight of the PCE children and non-PCE children, their Hobel Perinatal Risk Assessment scores did not differ considerably. Medical professionals assessed the risk of complications prenatally, during labor and delivery, and postnatally using the Hobel scoring system (Hobel 1973; Hobel 1979). The cocaine-exposed infants (mean=54.5; standard dev. =20.1) had significantly higher prenatal risk scores than the controls (mean =43.0; standard dev.

19.3), but there was no statistically significant difference on the labor and delivery ($p = 0.780$) or neonatal scores ($p = 0.135$).

Retention And Attrition At Three Year Follow Up

During the three-year follow up, the researchers collected data from each primary caregiver of the child during a home interview and from each child during a clinic appointment. The home interviews that were conducted with each primary caregiver included measures of the caregivers' psychosocial status (CES-D), the home environment (HOME), the families' social support system (FSS), and the children's adaptive behavior (Vineland). A trained interviewer conducted the home interviews. Also, a blinded clinician on or around the child's third birthday completed the child's developmental assessment (Bayley).

Of the initial 308 subjects, 80.2% (n=247) received both a home and a clinical assessment at age three. Ten of the children had died by age three and 14 families were lost to follow up or declined. Nine subjects completed either the home interview or the clinical assessment, but not both, and 39 missed some part of either the home interview or the clinic. As shown in Table 4.3, there is no significant difference between cocaine-exposed and non-cocaine-exposed groups in terms of their participation or lack of participation in the three year follow up (chi-square = 3.869 [4]; $p=0.424$). Additional analysis was done to compare the birth outcomes of the children who remained in the study to those who did not remain. There were no statistically significant differences between the initial sample's mean birth weight, Hobel complications assessment scores, gender, or prematurity status. Therefore, the 234 subjects with complete data are included in each bivariate and multivariate analysis with minimal risk of attrition bias.

Table 4. 3: Subject Retention and Attrition at 3-Year Follow Up

Participation in Study at 3 year Follow Up	**Control n= 144**	**Target n= 138**	**Total n= 282**
Completed Both	123 39.9%	124 40.3%	247 80.2%
Missed Clinic or Interview	6 1.9%	3 1.0%	9 2.9%
Incomplete Clinic or Interview	15 4.9%	11 3.6%	26 8.4%
Reasons for Exclusion from 3 year Follow Up	**Control n=10**	**Target n=16**	**Total n=26**
Child Died Prior to 3 year Follow-up	5 1.6%	5 1.6%	10 3.2%
Unable to Locate for Follow-up	5 1.6%	11 3.6%	16 5.2%
Total	154 50.0%	154 50.0%	308 100.0%
Pearson Chi-Square=3.869 (df=4) alpha=0.424			

Operationalization Of Variables and Hypotheses

Prenatal Risk: Prenatal Cocaine Exposure (PCE)

Prenatal cocaine exposure was determined by multiple measures including maternal drug histories and urine assays taken from the mother during pregnancy and from the child at birth. Positive urine screens were confirmed using the gas chromatography -mass spectroscopy process. Target subjects included any woman who admitted to using cocaine and all the women and children who had positive confirmed urine screens for cocaine. Those who denied use and had negative cocaine screens comprised the control group.

As in many of the studies of prenatal cocaine exposure, polydrug use exists among our sample of cocaine users. Both the cocaine users and some of the non-cocaine users reported the use of alcohol, marijuana, and tobacco. Subjects who reported the use of any illicit substance other than cocaine and marijuana were excluded from the study.

The amount of cocaine used by the cocaine users was determined from oral reports taken by the interviewer. Each cocaine user was asked how often they used cocaine, how much cocaine they used, or approximately how much money they spent on cocaine. The women in this study were primarily crack cocaine smokers. Their cocaine use ranged from smoking during as little as 2% of the time they were pregnant to as high as 100% of the time. On average, the cocaine users smoked crack during approximately 48% of their pregnancies (standard deviation = 0.28). Figure 4.2 is a histogram of the percent of weeks cocaine was used during the pregnancy for the cocaine users in the sample. Table 4.4 shows the comparisons between the cocaine and non-cocaine users drug habits including the cocaine use for the initial longitudinal sample.

The prenatal risk factor describes the children who were and who were not exposed to cocaine prenatally. All of the children of mothers who used cocaine during their pregnancy, regardless of the amount or timing of the use, were included in target or PCE group. This study is not a study of the variable effect of prenatal cocaine exposure, but a study of the differences between children who have been deemed "at-risk" due to prenatal cocaine exposure. Typically, the "at-risk" label is used without knowledge of maternal drug use during pregnancy, let alone the amount of cocaine used. Therefore, it in this particular analysis it is more appropriate to study the children who are "at-risk" of being labeled as "at-risk" than it is to study only the children with the greatest exposure to cocaine.

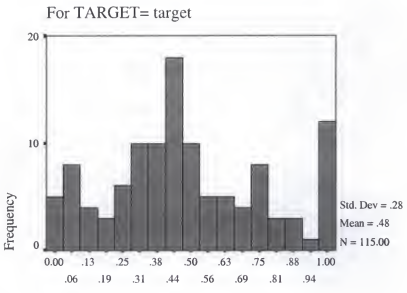


Figure 4. 2: Percent of Weeks Cocaine Used During Pregnancy, n=115

Table 4. 4: Biological Mothers Drug Use by Cocaine Exposure Status, n=308

	Non-Exposed n=154	Cocaine Exposed n=154	Total Sample N=308	Chi-Square Test p-values
Percent of Weeks Cocaine Used During Pregnancy	--	0.47+/-.30	--	--
Marijuana Use	7.1% (11)	44.2% (68)	25.6% (79)	.000
Tobacco Use	24.0% (37)	79.9% (123)	51.9% (160)	.000
Alcohol Use	30.5% (47)	76.6% (118)	53.5% (165)	.000

Outcome Measures: Behavior and Development

The multidimensional approach outlined in the previous chapter will be used to assess the differences in the behavior and development of prenatally and non-prenatally cocaine exposed children. The score on the *Vineland Adaptive Behavior Scales* (Sparrow, Balla, & Cicchetti 1984) will be used as a measure of behavior. The score on the *Bayley Scales of Infant Development* will be used to measure the children's development.

Behavior. The Vineland scale was designed to measure the personal and social adaptability of handicapped and non-handicapped individuals from birth through adulthood (Holden 1984). During a visit to each child's home, the instrument was administered to each child's primary caregiver in the form of a semi-structured interview. The Vineland was scored and interpreted by a trained test administrator upon its completion.

The Vineland survey consists of 297 items that cover four behavioral domains: (1) communication (receptive and expressive language); (2) daily living skills (self-care activities); (3) socialization (interpersonal relations and play activities); and (4) motor skills (gross and fine motor coordination). The standard scores range from 0 to 200 with higher scores reflecting higher levels of competence (Sparrow, Balla, and Cichetti 1984). Each primary caregiver reported whether or not her child performed the tasks satisfactorily and habitually or if the skill was emerging and/or adequately performed. If there had not been an opportunity to observe the child performing the tasks, the task was not included in the total score for that domain.

The standard scores for the Vineland were developed using a national standardized sample of 3,000 subjects drawn from a pool of 21,876 potential participants

representing the 1980 US Census figures by race, sex, community size, geographic region, and parental education (Holden 1984). The developers of the Vineland report test-retest correlations ranging from 0.98 to 0.99 and interrater reliability correlations ranging from 0.96 to 0.99 (Sparrow, Balla, and Cichetti 1984). The construct validity was reported as satisfactory based on an increase in raw scores for each age group, significant factor loading, and positive correlations with other intelligence scales, such as the Peabody Picture Vocabulary Test (Sparrow et al. 1984).

Development. The *Bayley Scales of Infant Development* (Bayley 1969) were designed for use in both clinical and research practices by Nancy Bayley in 1969. It provides an assessment of each child's developmental status in comparison to national norms. The scales were standardized on a stratified sample of non-institutionalized children selected from the 1960 United States Census. Almost 40 years after its inception, the Bayley Scales are still widely used among researchers. The primary strengths of the instrument are its norms that controlled for sex, race, urban versus rural residence and parental education, as well as its significant correlation with other intelligence scales such as the Stanford Binet (Whaley 1984).

A study by Werner and Bayley (1966) reports respectable statistical properties for the Bayley. Split-half reliabilities were reported for the mental and motor scales. The Spearman correlation coefficients for the mental scale ranged from 0.81 to 0.93 with a median of 0.88. The motor scale has resulting coefficients of 0.68 to 0.92 with a median value of 0.84. The test-observer and test-retest reliabilities were also favorable. The mean percentage of agreement between observers on the mental scale was 89.4 (standard deviation = 7.1) and 93.4 (standard deviation = 3.2) on the motor scale. The test-retest

reliability score for the mental scale was reported as 0.76; however, the motor score was not reported in the review (Whaley 1984).

In this study, a clinician completed the Bayley during the children's three-year follow-up at the hospital or clinic. The clinician used the Bayley to assess each child's mental and motor skills. Like the Vineland, the standard scores on the Bayley range from 0 to 200 where higher scores reflect a higher level of competence (Bayley 1969). The mean on the mental and motor index is 100 with a standard deviation of 16. Interpreters of the Bayley and the Vineland have placed the scores in the following range: Low (less than 69), moderately low (70-84), adequate (85-115), moderately high (116-130), and high (131 or above).

> Hypothesis 1: Based on my review of the biomedical and behavioral literature on the effects of prenatal cocaine exposure, I hypothesize that in a bivariate analysis, the children who have been prenatally exposed to cocaine will have lower scores on both the Vineland and the Bayley than children who have not been prenatally exposed to cocaine. However, this prediction changes when the neonatal and postnatal factors are considered.

Neonatal Risk: Newborn Health Status

Based on biomedical and behavioral research there is a relationship between poor health at birth and poor developmental outcomes in infancy and in some cases early childhood. Each child's risk of experiencing physiological problems that require medical attention was assessed at birth using the *Hobel Perinatal Complications Scale* (Hobel, Hyvarinen, Okada & Oh 1973). Medical personnel determined each child's neonatal risk after reviewing the mother and child's medical records, which included an assessment of prenatal risk, neonatal risk, and an assessment of the complications incurred during labor and delivery. The scores on these assessments indicate each child's risk of experiencing health problems that may require medical attention in the future.

The neonatal risk score ranges from 0 to 35. A score of 10 or higher indicates a greater risk of having physiological problems during infancy and beyond. In order to test the reliability of the instrument, Hobel and his associates (1979) tested the scale's ability to predict infant mortality. They found that the neonatal risk score predicted infant mortality correctly 82.5% of the time (Hobel, Youkeles & Forsythe 1979). Hence, children with lower risk scores should experience better health outcomes, thus compensating for the risk associated with prenatal cocaine exposure.

> Hypothesis 2: Using the multidimensional model, I predict that regardless of cocaine exposure status, fewer neonatal risks will result in higher scores on the adaptive behavior and developmental scales. Additionally, the neonatal risk will serve as a significant predictor of adaptive behavior and development when included in the multidimensional model.

Postnatal Factors: Social Ecological Model

The postnatal environment reflects the social ecological model adapted from Bronfenbrenner's (1979) work. Using Bronfenbrenner's ecological model of human development as a guide, I have constructed four systems or dimensions that characterize the postnatal environment: the micro-, meso-, exo-, and macrosystems. The microsystem represents the setting closest to the child and it is operationalized using a measure of the primary caregiver's psychosocial status. The mesosystem characterizes the relationship between the child and his or her home environment. According to Bronfenbrenner, the exosystem reflects the setting that does not directly involve the child, but may have an influence on the child's development. It is operationalized as the family's social support system. Last, the macrosystem is comprised of a measure of the child's race and the family's household income.

At age three, 26.5% (n=62) of the children in the total sample do not live with their biological mother (see Table 4.5). In each case, the individual who had custody

and/or who was primarily responsible for the child's care has been classified as the child's primary caregiver. The responses from the interview with the primary caregiver are used to construct the variables in the social ecological model, which represents the postnatal environment, the second compensatory factor in the multidimensional model.

Table 4. 5: Caregiver's Relationship to Child at Age Three by Cocaine Exposure Status

	Non-Cocaine Exposed n=119	Cocaine Exposed n=115	Row Percents n=234	Z-Test Statistic p-value
Biological Mother	66.3% (114)	33.7% (58)	100% (172)	-7.844 0.000
Biological Father	12.5% (1)	87.5% (7)	100% (8)	-2.203 0.028
Adopted Mother	--	100% (5)	100% (5)	-2.294 0.022
Grandmother	13.3% (2)	86.7% (13)	100% (15)	-2.998 0.003
Other Relative	--	100% (12)	100% (12)	-3.610 0.000
Foster Mother	9.1% (2)	90.9% (20)	100% (22)	-4.108 0.000

Microsystem: Primary Caregiver's Psychosocial Status. Each child's primary caregiver's psychosocial status is determined by her score on the *Center for Epidemiologic Studies – Depression Scale (CES-D).* The CES-D is a self-report of depressive sympotomology designed for use in research settings with non-clinical or non-psychiatric populations. It consists of twenty questions rated on a four-point scale. Each question indicates how frequently the respondent experienced a particular set of symptoms during the past week. Factor analysis reported by Radloff (1977) indicates that the CES-D can be broken into four dimensions: positive affect, negative affect,

somatic concerns, and interpersonal concerns. However, given the high degree of internal consistency, it is recommended that a total score be used in statistical analysis.

A total score of 16 typically points to the presence of depressive symptomology. A score below 16 suggest that the individual is probably not at risk for depression. A score between 16 and 20 means the individual has expressed mild depressive symptomology. A score ranging from 21 to 30 reflects a risk of experiencing moderate depression and a score of 31 or above indicates severe risk of receiving a diagnosis of depression. However, it is duly noted that this is not a clinical assessment, but a diagnostic tool or screen to measure depressive symptoms in the general population (Devins and Orme 1984).

The test was created in the early 1970s and tested on randomly selected adults living in households chosen from a probability sample of households in Kansas City, Missouri or Washington County, Maryland. Numerous researchers have reviewed the psychometric properties of the CES-D. Initial reports by Devins and Orme (1984) on the test-retest reliability appear quite low (two week estimate $r = 0.51$; four week estimate $r = 0.67$), but it is presumed that the low scores are due to the fact that the scale measures symptoms that occurred within the last week. So, as people and their life circumstances change, the results from one week to the next are expected to change as well.

The internal consistency is a more useful measure of reliability for an instrument that measures changing states or moods such as the CES-D. Using Cronbach's alpha, Radloff (1977) reports Pearson correlation coefficients of 0.84, 0.85 and 0.90 meaning that the items in the instrument all appear to be measuring the same construct.

Weissman and associates (1977) tested the construct validity of the CES-D by testing individuals undergoing psychiatric treatment. It was reported that the depressed group in the sample received higher scores on the CES-D than the recovered and non-depressed groups. Additional studies confirm the construct validity of the CES-D by comparing the results of the CES-D to those of other depression scales. The CES-D is reportedly highly correlated with the Symptom Checklist 90, another scale designed to measure psychological distress and depressive symptomology. The correlation coefficients ranged from 0.70 to 0.80 (Derogatis, Lipman, and Covi 1973).

> Hypothesis 3: Using the multidimensional model, I predict that regardless of cocaine exposure status, the primary caregivers' score on the CES-D will be correlated with the adaptive behavior and developmental scores for their child. As the number of depressive symptoms increases, the scores on the adaptive behavior and developmental skills scales will decrease. Additionally, the primary caregiver's depression status will serve as a significant predictor of behavior and development in the multidimensional model.

Mesosystem: Home Environment. The mesosystem will be measured by assessing the physical and parenting environments in the home of the child. The physical and parenting environment will be operationalized using Caldwell and Bradley's (1979) *Home Observation for Measurement of the Environment (HOME) Inventory.* The HOME was completed during the interview with the primary caregiver. The interviewer completed the HOME by asking each caregiver questions and by observing the family's behavior and the nature of the environment. The *HOME* was designed as a standard way for researchers to ascertain the nature and quality of the physical and parenting environment as they relate to children's cognitive development.

The HOME scale was standardized on families in Little Rock, Arkansas and Syracuse, New York. The sample was not random or stratified, but the researchers did

over sample low income and Black families. The revision of the HOME, which took place in 1984, was tested on 232 families in Little Rock of whom 30% were welfare recipients, 66% were Black, and the average level of education was 11 years of schooling. The version of the scale designed for children of this age consists of eight subscales: learning stimulation, academic stimulation, physical environment, variety in experience, language stimulation, warmth and acceptance, modeling, and acceptance. The Kuder-Richardson reliability estimate for the total scale is 0.93 and the test-retest reliability ranges are as high as 0.70 depending on the subscale (Procidano 1985).

For purposes of this study, the home is divided into two factors: the parenting environment and the physical environment. The parenting environment consists of the items on the HOME that measure the primary caregiver's interaction with the child within the home. The physical environment consists of the items that measure the homes' physical attributes. Two factor analyses were conducted to determine the viability of these two domains.

The factor loadings for the parenting dimension ranged from 0.56 to 0.78. The eigenvalue was 2.56 and it explained 51.25% of the variance. The language stimulation, warmth and acceptance, academic stimulation, modeling, and acceptance subscales, which make up the parenting factor, maintained statistically significant correlations of 0.74 or greater with the parenting factor.

The factor loading for the physical dimension ranged from 0.66 to 0.81. The eigenvalue was 1.77 and it explained 58.98% of the variance. The physical dimension consists of the learning stimulation, physical environment, and variety in experience

subscales. Each of these maintained statistically significant correlations with the parenting dimension ranging from 0.66 to 0.82.

In this study, the scores on the parenting dimension range from 1 to 6 with a mean of 4.26 (standard deviation = 0 .89). The physical dimension ranges from 1 to 6 with a mean of 5.67 (standard deviation = 1.60). The higher the score, the more positive attributes found in the home environment.

> Hypothesis 4: Using the multidimensional model, I predict that regardless of cocaine exposure status, the parenting environment and the physical environments will be correlated with the adaptive behavior and developmental scores. As the number of positive attributes in each dimension increases, the scores on the adaptive behavior and developmental skills scales will increase. Additionally, the parenting and the physical environments will serve as significant predictors of behavior and development in the multidimensional model.

Exosystem: Family and Social Support System. The exosystem refers to the quality of the family's social support system. The families' social support system is measured using the *Family Social Support Scale (FSS).* The FSS scale measures the existence of particular family and community support networks and how helpful they have been to the family during the last twelve months (Dunst 1985). The primary caregiver is asked to indicate on a 19-item list how helpful immediate and extended family members and community and professional agencies have been in the past year. The family members included in the survey include those of the child and the child's primary caregiver. Using a likert scale ranging from 0 (not at all helpful) to 4 (extremely helpful) each supporter is ranked with the exception of those who do not apply. The total score is computed by adding up each rank. In this study, the scores on the Family

Support Scale ranged from 12 to 76 with a mean of 38.43 (standard deviation = 11.96). The scale is an assessment of the quality of the support available to the primary caregiver.

Dunst, Trivette, and Jenkins (1988) report promising psychometrics from a study of 139 parents of pre-school children with developmental disabilities. The alpha coefficient for the measure of validity was 0.77. The split-half reliability measured by the Spearman-Brown formula was 0.77 and the Pearson test-retest reliability coefficient after one month was reported as 0.75.

> Hypothesis 5: I predict that regardless of cocaine exposure status, the quality of family support will be correlated with adaptive behavior and development. As the number of positive supports available to the family increases, the scores on the adaptive behavior and developmental skills scales will increase. Additionally, I hypothesize that the family support dimension will serve as a significant predictor of behavior and development in the multidimensional model.

Macrosystem: Social Structural Variables. In most sociological research, demographic characteristics are added into the analysis with very little thought about the intricate connection between sociodemographics and outcomes. There is enough empirical evidence available to support the contention that structural variables such as race, class, and gender do matter (Allport 1988; Davis 1991; Hacker 1992; West 1993). Bronfenbrenner describes the macrosystem as the setting that represents the culture or subculture in which the other settings or systems reside. He predicts that the nature of the micro-, meso-, and exosystems will vary depending on the characteristics of the macrosystem. For example, "homes, day care centers, neighborhoods, work settings, and the relations between them are not the same for well-to-do families as for the poor" (Bronfenbrenner 1979: 26).

In this study, I have constructed four dummy variables that represent the race and economic status of each family. The race of the family is determined by the race of the

biological mother. Each biological mother was classified as either Black or non-Black based on self-reports, upon enrollment into the study. I realize this is a crude estimate of the family's race, but unfortunately, the official racial classification of the children and their primary caregivers was unavailable. However, one could argue that in most cases a child's race is determined by his or her biological mother's race (unless the biological father is Black and the mother is not Black, whereas the child is typically classified as Black); therefore, using this classification is not completely unreasonable.

The families' household income was collected during the home interview. Each primary caregiver was asked to classify her families' entire household income into one of five categories: (1) $0 to $6,000, (2) $6,001 to $12,000, (3) $12,001 to $18,000, (4) $18,001 to $24, 000, and (5) $24,000 or more. I used these categories to construct a poverty variable. The poverty variable measures whether or not the family is living at or below the poverty line based on the 1998 poverty threshold of $16,600 for a family of 4 (NCCP 2000). I took the largest number in each range and divided it by the number of people living in the household. This number was then measured against the poverty line and those families with household incomes equal to or below $16,600 were classified as a "1" meaning below poverty and those who had an income of $16,601 or greater were classified as a "0" or above poverty.

The poverty variable was then added to the race variable to create four dummy variables: BlackPoverty (family with a Black child living below poverty), Non-BlackPoverty (family with a Non-Black child living below poverty), BlackAbove (family with a Black child living above poverty) and Non-BlackAbove (family with a Non-Black

child living above poverty). The BlackPoverty variable is the referent group in the multidimensional model.

One of the strengths of the data used in this study is the existence of a matched sample of cocaine and non-cocaine exposed children. The cocaine using and non-cocaine using women were matched on race, parity, perinatal risks, and socioeconomic status at the time of enrollment (see Table 4.1). Therefore, no significant differences exists between the cocaine and non-cocaine exposed children in terms of their sociodemographics at birth. At age three, still there are no statistically significant differences between the two groups' race ($z=-0.292$; $p=0.770$) and household incomes ($z=-0.695$; $p=0.487$).

> Hypothesis 5: Using the presumed significance of race and class in the social ecological model, I hypothesize that the families with a non-Black child and higher household incomes will have children who perform better on the behavioral and developmental scales than Black or non-Black children living with impoverished families. In the multidimensional model, I predict that the NonBlackAbove variable will be a stronger predictor of behavior and development than the other RaceIncome dummy variables given that BlackBelow is the reference group.

Summary

The basic hypothesis presented in this chapter is that, regardless of children's cocaine exposure status, the postnatal environment is a significant predictor of behavioral and developmental outcomes for pre-school aged children. The multidimensional model summarizes the relationship between the prenatal, neonatal, and postnatal environment. I predict that factors in the neonatal and the postnatal environment will compensate for the risk associated with the prenatal environment, thus reducing the effects of prenatal cocaine exposure on early childhood outcomes. I expect that in the bivariate analysis presented in the following chapter, that the effects of prenatal cocaine exposure will be

minimal due to the strength of the other risks associated with this group of children. The multivariate analysis is expected to indicate which biomedical and social ecological factors measured in this study will explain differences in behavioral and developmental outcomes.

In the next chapter, I test each of the above hypotheses within the context of the multidimensional model. Table 3.1 lists the measures that are used to operationalize each dimension in the model. The table outlines the constructs representing each dimension and the standardized instruments used to measure each construct.

Table 4. 6: Description of Variables in Multidimensional Model

VARIABLES	DESCRIPTION	MEASURES
Dependent Variables (Scale)		
Adaptive Behavior (0–200)	A composite score obtained from a behavior rating scale.	Vineland Adaptive Behavior Scales (Sparrow, Balla, & Cicchetti 1984)
Development (0–200)	A composite score obtained from a developmental rating scale.	Bayley Scales of Infant Development (Bayley 1969)
Prenatal Dimension		
Cocaine Status No=0; Yes=1	Cocaine or non-cocaine exposed child targeted for the research study.	Prenatally Exposed
Neonatal Dimension		
Infant Risk Factors <10=risk	Measure a newborns risk of poor health outcomes.	Hobel Neonatal (Hobel, Hyvarinen, Okada, & Oh 1973; Hobel, Youkeles, & Forsythe 1979)
Postnatal Dimension (Social Ecological Factors)		
Microsystem		
Psychological Characteristics <16=risk	Measure of the primary caregivers' risk for depression.	Center for Epidemiologic Studies Depression Scale (CES-D) (Radloff, 1977)
Mesosystem		
Parenting Environment (0-6)	What are the nature, quality, and quantity of the interaction between the primary caregiver and the child in the home?	HOME Subscales II, IV, V, VI, VIII (Caldwell & Bradley 1984)
Quality of Home Environment (0-6)	The nature of the family's physical residence, including assessments of safety, nurturing, and developmental stimulation.	HOME subscales I, III, VII (Caldwell & Bradley 1984)
Exosystem		
Family Support System (0-76)	The quality of support provided to primary caregiver from others.	Family Social Support Scale (Dunst, Jenkins, & Tivette 1984) (Dunst, Trivette, & Deal 1988)
Macrosystem		
Sociodemographic Characteristics NonBlack=0; Black=1; NotPoor=0; Poor=1	Social and demographic description of the primary caregiver and child.	Child's Race Household Income

CHAPTER 4
DATA ANALYSIS AND RESULTS

Analytical Procedures

In this chapter, I present the findings from the bivariate and multivariate analyses of the multidimensional model. Each measure included in the model is presented in terms of the differences between the prenatally cocaine exposed (PCE) and non-PCE groups using the Mann-Whitney test. The Mann-Whitney test is a nonparametric test equivalent to the *t-test*, but it does not require that the sample meet the strict assumptions of a *t-test*. Nonparametric procedures are useful for studies like this one because of its small non-normally distributed sample. The Mann-Whitney test assumes identical shapes when comparing the population distributions, but it does not require the populations to be "normal" or to be centered around the mean. The Mann-Whitney test is more powerful than a median test since it uses the ranks of the cases. It requires an ordinal level of measurement. The resulting mean rank sum is called U. The U represents the number of times a value in the first group is smaller than a value in the second group, when values are sorted in ascending order (Agresti and Finlay 1986; Hildebrand 1986; SPSS 2001).

In addition to analyzing the differences between the prenatally cocaine and non-cocaine exposed infants on the measures of their neonatal and postnatal social environments, the relationship between each environmental factor is analyzed using the Spearman's correlation coefficient. Spearman is a nonparametric version of the Pearson

correlation coefficient. It is based on the ranks of the data rather than the actual values. Like the Pearson's correlation coefficient, the values of the coefficient range from -1 to +1 where the sign of the coefficient indicates the direction of the relationship. The absolute value indicates the strength of the relationship with larger absolute values indicating stronger relationships between variables (SPSS 2001).

The multivariate analysis includes the measures of the prenatal, neonatal and postnatal environment as biomedical, behavioral and social predictors of behavior and development. Using generalized linear regression which allows the response variable to have a non-normal distribution, I have created three models of behavior and three models of development. The standardized regression coefficients are presented in order to demonstrate the relative strength of each predictor in each model. The higher the standardized regression coefficient and the smaller the p-value, the stronger the predictor. The first model includes the measure of prenatal risk or prenatal cocaine exposure as a predictor of either behavior or development. The second model adds the neonatal factor or the measure of health risks and the third model includes the prenatal, neonatal and the postnatal factors as predictors of behavior and of development. These models reflect the proposed additive or compensatory influence each factor has on pre-school aged children's behavior and development.

The analysis begins with the questions posed in the introductory chapter. First, is there a difference in the behavior or the development of PCE children and non-PCE children? Second, to what extent do neonatal and postnatal factors hinder or enhance behavioral and developmental outcomes among this group of "at-risk" children?

Differences between PCE children and non-PCE children

Birth Characteristics

In chapter 4, I described the characteristics of the longitudinal sample at birth. The number of subjects used in this study has been reduced from 308 to 234, in order to have complete data on each of the measures included in the multidimensional model. The following table describes the characteristics of the reduced sample at birth.

Table 5. 1: Birth Outcomes by Cocaine Exposure Status, Means+/-Standard Deviations (Mean Rank)

	Non-Cocaine Exposed n=119	Cocaine Exposed n=115	Total Sample N=234	Mann-Whitney p-values
Female Infants	0.43+/-0.05 (112.64)	0.53+/-0.05 (122.53)	0.47+/-0.50	0.197
Premature Infant = Yes	0.08+/-0.28 (114.83)	0.13+/-0.34 (120.26)	0.11+/-0.31	0.252
Infant's Birth Weight	3179.9+/-618.7 (126.7)	2985.5+/-614.2 (108.0)	3130.5+/-620.2	0.034
Hobel Prenatal	44.62 +/-19.36 (124.47)	54.61 +/-17.47 (176.04)	49.53+/-19.08	0.000
Hobel Labor & Delivery	19.75 +/17.44 (148.63)	18.96 +/14.44 (151.40)	19.36 +/-16.01	0.789
Hobel Neonatal	15.43 +/-29.93 (142.64)	15.64 +/-21.46 (157.51)	15.54 +/-26.06	0.107

When compared to the longitudinal sample described in Table 4.2, the mean percentage of females in the sample has not changed (47%), even though the significance level has changed due to the smaller sample size. The difference in the number of premature births for the PCE and non-PCE groups has changed. There are fewer

premature children in the reduced sample and the difference between the non-PCE and non-PCE groups is no longer statistically significant (p=0.252). There is a statistically significant difference between the two groups in terms of mean birth weight for the children, however this sample indicates that the average birth weight of the children included in the three year follow up is higher than the initial longitudinal sample.

The differences between the initial longitudinal sample and the children included in the three year follow up are subtle, but they do indicate that the children with higher birth weights and fewer perinatal complications were more likely to have completed all assessments at age three. Unfortunately, this is a consequence of doing longitudinal research with human subjects that is very difficult if not impossible to control. The families that are most accessible are typically the ones who are engaged in research and from these numbers those families tend to be the ones with stronger or healthier children, a fact that is true for most research, but is often negated. The researchers made a special effort to control for the social demographics and health related risks that may confound any observed differences between the PCE and non-PCE children, but it is difficult to control for attrition. Therefore, it is important to keep in mind that the conclusions drawn in the following analyses reflect the differences between the two groups of the families who were engaged in this research project, but they may or may not reflect the general population.

Neonatal Environment

Maternal drug use during pregnancy is one of the items used to construct the *Hobel Perinatal Complications Scale*. It is expected that children who were prenatally exposed to any type of illicit drug or alcohol will have more health problems than their non-exposed counterparts. The neonatal assessment represents the risk of health

complications for the newborn infant, while the prenatal score is an assessment of prenatal risk to the fetus and the labor and delivery score is used to determine the risk of complications that the mother and child may encounter during delivery. Only the neonatal assessment score is used in the multivariate analysis, because it encompasses the prenatal and the labor and delivery risk scores. In this sample of "at-risk" children, there is no statistically significant difference between PCE children and the non-PCE children's mean score on the neonatal complications scale ($z=-1.611$; $p=0.107$).

The neonatal score of the PCE children (mean=15.6; standard deviation=21.5) is slightly higher than the non-PCE children (mean=15.4; standard deviation=29.9), but this difference is only approaching statistical significance, whereas the difference between the PCE (mean=54.6; standard deviation=17.5) and non-PCE children (mean=44.6; standard deviation=19.4) on the prenatal risk assessment is significantly different ($p=0.000$). Hence, as time passes, among the fetuses that survive the pregnancy and the infants who survive the birthing process, the health risk associated with prenatal cocaine exposure dissipate. But, it is important to note that both groups have neonatal risk scores above 10, which indicates considerable risk for health complications during infancy and early childhood.

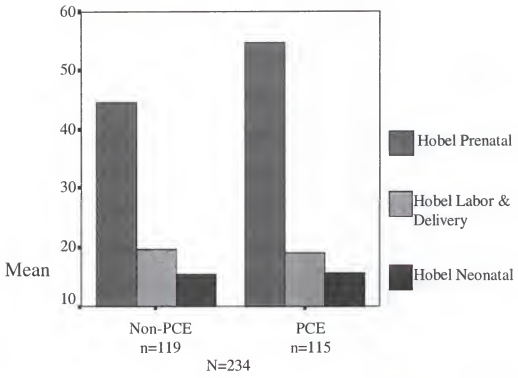


Figure 5. 1: Hobel Complications Scale by Prenatal Cocaine Exposure Status

Postnatal Environment

Within the postnatal environment, prenatal cocaine exposure has even less association with the nature of the environment. As shown in Tables 5.2 and 5.3, there are minimal differences between the PCE and non-PCE children in terms of their social environment as measured using the social ecological factors.

Microsystem. According to the results on the Center for Epidemiologic Studies-Depression scale (CES-D), there is a statistically significant difference between the depression status of the primary caregivers with PCE children and those with non-PCE children. The primary caregivers with non-PCE children have slightly higher scores on the CES-D (mean = 22.88; standard deviation=9.17) than the primary caregivers with PCE children (mean = 19.97; standard deviation = 10.77). Both groups received scores above 16, which typically indicates a risk for depression. On average, both groups of caregivers reflect a moderate risk for depression, a trend that is also related to whether or not the primary caregiver is the biological mother or not. Non-cocaine exposed children are more likely to be living with their biological mother than cocaine exposed children (chi-square = 75.97, p=0.000). This relationship between prenatal cocaine exposure and parental status is explored further in the section of this chapter that describes the relationships between the environmental factors and outcomes.

Mesosystem. The nature of the home environment was measured using the *HOME* scale. If one were to assume that women who used drugs during their pregnancy are less likely to live in and/or maintain stable and nurturing households due to their drug behavior, then it would be safe to postulate that the children who were prenatally exposed to cocaine would live in poorer home environments. However, among the children in this sample, very few of the PCE children still live with their biological mother at age three. So, this hypothesis can not be fully evaluated.

Table 5. 2: Postnatal Differences between PCE and non-PCE children at the Microsystem and Mesosystem Level, Mean +/- Standard Deviation (Mean Rank)

	Non-Cocaine Exposed N=119	Cocaine Exposed N=115	Total N=234	Mann Whitney p-value
Microsystem - Psychosocial Dimension				
CES-Depression Scale	22.88+/-9.17 (127.78)	19.97+/-10.77 (106.87)	21.45+/-10.07	0.018
Mesosystem - Home Environmental Dimension				
Physical Environment	5.63+/-1.57 (116.71)	5.71+/-1.65 (118.32)	5.67+/-1.60	0.856
Home I: Learning Stimulation (0-11)	5.61+/-2.63 (112.22)	6.11+/-2.75 (122.97)	5.86+/-2.70	0.222
Home III: Physical Environment (0-7)	5.46+/-1.81 (121.76)	5.25+/-1.87 (113.10)	5.36+/-1.84	0.310
Home VII: Variety in Experience (0-9)	5.81+/-1.68 (118.83)	5.76+/-1.62 (116.12)	5.78+/-1.65	0.755
Parenting Environment	4.59+/-0.96 (115.79)	4.70+/-0.10 (119.27)	4.26+/-0.89	0.694
Home II: Language Stimulation (0-7)	6.26+/-1.01 (115.34)	6.30+/-1.04 (119.73)	6.28+/-1.02	0.579
Home IV: Warmth and Acceptance (0-7)	5.17+/-1.55 (108.82)	5.49+/-1.65 (126.48)	5.32+/-1.60	0.041
Home V: Academic Stimulation (0-5)	3.73+/-1.26 (109.64)	4.06+/-1.08 (125.63)	3.89+/-1.18	0.058
Home VI: Modeling (0-5)	3.22+/-1.66 (124.13)	2.95+/-1.31 (110.64)	3.09+/-1.24	0.117
Home VIII: Acceptance (0-4)	2.82+/-1.20 (123.81)	.65+/-1.12 (110.97)	2.74+/-1.16	0.131

There are no significant differences between the PCE and non-PCE children's parenting environments or their physical home environments, with one exception. The parenting environment of the PCE children is slightly higher on the measure of maternal warmth and acceptance ($p = 0.041$) and academic stimulation ($p = 0.058$). These

differences indicate that the prenatally cocaine exposed children are living with primary caregivers who show more warmth and acceptance and provide more academic stimulation than the primary caregivers of the non-PCE children. The fact that most of the primary caregivers for the PCE children are not the biological mothers makes this finding quite interesting. Yet, further analysis did not show a relationship between the different subdomains on the HOME and the caregiver status of the biological mother. Across the different domains of the HOME, the physical home environment and the parenting environment of the PCE and non-PCE groups is not significantly different, nor is it different when controlling for the caregiver status of the biological mother.

Exosystem. The exosystem is measured using the *Family Social Support Scale*. This scale assesses the quality of the social support available to the primary caregiver. Within this study sample, the primary caregivers with a non-cocaine exposed child had a mean level of support of 39.31 (standard deviation = 10.93) and the primary caregivers with a prenatally cocaine exposed child had a slightly lower level of support at 37.52 (standard deviation = 12.92). These differences were not statistically significant ($p=0.112$), but they do represent a relatively low level of social support. On a scale of 0 to 76, the mean level of support for both groups was only 38.43 with a standard deviation of 11.96.

Due to how the social support scale is defined in different studies, it is difficult to ascertain what a "normal" level of support is for "at-risk" families. The range of support varies from one population to another depending on how many supports are available to the family, but a mean that falls at or below the midpoint of 38 indicates that there is

either a low level of support available to these families and/or the available supports are not necessarily helpful (see Table 5.3).

Table 5. 3: Postnatal Differences between PCE and non-PCE children at the Exosystem and Macrosystem Level, Mean +/-Standard Deviation (Mean Rank)

	Non-Cocaine Exposed n=119	Cocaine Exposed n=115	Total n=234	Mann-Whitney p-value
Exosystem - Family Social Support Dimension				
Family Support Scale (12.00 - 76.60)	39.31+/-10.93 (124.40)	37.52+/-12.92 (110.36)	38.43+/-11.96	0.112
Macrosystem - Social Structural Dimension				
Child's Race=Black	0.83+/-0.38 (118.31)	0.82+/-0.39 (116.63)	0.82+/-.38	0.770
Families Living Below Poverty	0.71+/-0.45 (121.07)	0.65+/-0.48 (113.80)	0.68+/-.47	0.308
Black Below Poverty	0.68+/-0.47 (122.14)	0.60+/-0.49 (112.70)	0.64+/-0.48	0.199
Black Above Poverty	0.15+/-0.36 (113.70)	0.22+/-0.41 (121.43)	0.18+/-0.39	0.193
Non-Black Below Poverty	0.03+/-0.18 (116.43)	0.05+/-0.22 (118.60)	0.04+/-0.20	0.484
Non-Black Above Poverty	0.13+/-0.34 (117.73)	0.13+/-0.34 (117.26)	0.13+/-0.34	0.928

Macrosystem. According to the tenets of urban sociology, poverty causes social disadvantages that can have a profound effect on the victim's health, behavior, and life course trajectory (Furstenberg, Cook, Eccles, Elder, and Sameroff 1999; Wilson 1987). By matching the two groups, the researchers were better able to control for the differences in birth outcomes caused by the cumulative effects of social disadvantage. There are no significant differences between the PCE children and the non-PCE children in terms of their race or household income by design. The majority (82%) of the children

in the sample are classified as Black and 68% of the families live below the poverty line with an income of less than $16,600 for a family of four.

Sixty-four percent of the children are Black and living below poverty. Eighteen percent of the sample includes black children living above poverty. Non-Black children living below poverty make up 4% of the sample, while non-black children living above comprise 13% of the sample. Respectively, the majority of the Black children live below poverty and the majority of non-Black children live above poverty.

Thus far, there have been very few differences between the PCE and the non-PCE children in this sample. The data indicates that there are slight differences in the characteristics of the home and the primary caregivers' psychosocial status; whereas the cocaine exposed children are residing with caregivers who are less likely to be depressed and who express more warmth and acceptance towards the child. Given the fact that the majority of the PCE children are not living with their biological mother at age three, these findings are interesting, but not antithetical. The better home environment among the PCE children suggests that the PCE children have not only been removed from their biological mothers, but they have been removed from less supportive environments as well. The findings presented thus far also indicate that the group of children included in this sample have considerably high neonatal risk scores, a greater likelihood of living with a depressed primary caregiver and in homes that can be considered less than perfect.

Behavior and Development

The next question asks whether there is a relationship between the child's environment and the child's behavioral and developmental outcomes. Despite the contradictory and inconclusive evidence in the literature on the effects of prenatal cocaine exposure, most people assume that children who have been prenatally exposed to cocaine

are developmentally delayed resulting in severe behavior problems. The research findings presented here suggest otherwise.

Among this sample of 234 children, there are no significant differences between the PCE children and the non-PCE children on any of the behavior or developmental domains measured by the *Vineland Adaptive Behavior Scales* (Vineland) or the *Bayley Scales of Infant Development* (Bayley). Table 5.4 shows the results for both scales and each of the subdomains. In fact, the PCE children actually have higher mean scores than the non-PCE children on the Vineland's communication domain ($p = 0.151$), socialization domain ($p = 0.091$), and motor skills domain ($p = 0.169$). Even though these results do not represent a statistically significant difference, they are indicative of the trends mentioned earlier, whereas the PCE children are living with less depressed caregivers, in more nurturing home environments, with slightly higher household incomes than non-PCE children.

However, as indicated in Table 5.4, the scores for both groups on the Vineland (mean = 98.5; standard deviation =14.7) and the Bayley (mean = 90.4; standard deviation = 15.4) are teetering between moderately low and average given the high standard deviation. Fifty-five percent of the children scored below 100, the national average, on the Vineland, while 72% received scores below the national average of 100 on the Bayley. The low performance on these nationally standardized tests indicate that this group of children, regardless of their cocaine exposure status is at risk of poor behavioral and developmental outcomes. This finding is inconsistent with the popular belief about the effects of cocaine exposure on behavior and development, but it is consistent with the belief that this group of children is at risk of developmental problems which could lead to

behavioral difficulties, for there is a significant correlation between the behavior and development (rho=0.473; p=0.000).

Table 5. 4: Adaptive Behavior and Development by Cocaine Exposure Status, Means +/- Standard Deviations (Mean Rank)

	Non-Cocaine Exposed n=119	Cocaine Exposed n=115	Total N=234	Mann-Whitney p-values
Adaptive Behavior (Vineland) (Range: 20 -160)	97.27 +/- 14.19 (113.12)	99.81 +/- 15.16 (122.03)	98.51+/- 14.70	0.314
Communication	98.22+/-14.32 110.74	101.20+/-13.99 123.43	99.69+/- 14.20	0.151
Daily Living Skills	103.23+/-14.05 120.33	101.63+/-14.77 114.57	101.52 +/- 13.79	0.515
Socialization	97.68+/-12.62 110.14	99.92+/-13.09 125.11	98.63+/- 12.06	0.091
Motor Skills	95.32+/-16.13 111.52	96.50+/-15.39 123.69	96.05+/- 15.62	0.169
Development (Bayley) (Range: 50 - 150)	90.59+/- 15.97 119.63	90.21+/- 14.88 115.30	90.40 +/- 15.41	0.624
Motor Skills	95.95+/-18.15 121.53	94.07+/-18.06 113.33	95.02 +/- 18.09	0.354
Mental Skills	85.23+/-16.79 116.18	86.35+/-15.62 118.86	85.78 +/- 16.20	0.762
Interpretation of Scales: Low (> 69), moderately low (70-84), adequate (85-115), moderately high (116-130), high (131 or above)				

So, if prenatal cocaine exposure does not explain the differences between children in terms of their behavior and development, what does? The multidimensional model suggests that the neonatal and postnatal environments compensate for the risk caused by the prenatal environment. In this next section, I explore the relationship between each environmental dimension, behavior and development, and the early childhood outcomes.

Environmental Factors and Early Childhood Outcomes

Prenatal Risk and Outcomes

In the bivariate analysis, PCE was not significantly correlated with any of the social ecological factors from the postnatal environment with the exception of the primary caregiver's depression score (rho= -0.155; p=0.018). Apparently, the primary caregivers who were caring for a non-PCE child had higher scores on the depression inventory than the primary caregivers with a PCE child. This enigmatic finding may be better understood within the context of the relationship between the primary caregiver and the child.

Approximately 50% of the PCE children did not live with their biological mother at age three, whereas only 4.2% of the non-PCE did not live with their biological mother at this same point in time. Hence, the non-cocaine using mothers are more likely to maintain custody of their children (rho=-0.514; p=0.000), and they are more vulnerable to depressive symptomology (rho=0.371; p=0.000) which is significantly correlated with the nature of the parenting environment (rho = -0.179; p=0.006), the physical environment (rho=-0.157; 0.017), family social support (rho=-0.185; p=0.005); and the family's poverty status (rho=-0.143; p=0.029) as shown in Table 5.5. Therefore, regardless of cocaine exposure status, the children in this study are "at-risk" of living in poor home environments with low quality social support, and limited economic resources when compared to the norms used in the standardization tables for each measure.

Neonatal Risk and Outcomes

Using the multidimensional model, I predict that there will be a relationship between the neonatal environment and behavior and development. The model infers that positive health outcomes for newborns results in better behavioral and developmental

outcomes for toddlers. While prenatal cocaine exposure poses a risk to behavioral and developmental outcomes, the neonatal and postnatal environment serve to compensate for prenatal complications. "At-risk" children who are born in a hospital, typically receive extra care and attention neonatally; and in the case of the cocaine exposed children, the extra care extends beyond their stay in the hospital. This is exemplified by the termination of parental rights for drug addicted mothers and/or the child's enrollment in social service programs designed to monitor the child's progress (i.e. Department of Children and Families). Hence, according to the compensatory model of resilience used to organize the multidimensional model, low neonatal health risk and a positive postnatal environment should compensate for the risk associated with a negative prenatal environment.

In this sample of "at-risk" children, the neonatal risk score is significantly correlated with adaptive behavior (rho=-0.143; p=0.028) and it is marginally correlated with development (rho=-0.110; p=0.094) as shown in Table 5.5. As the number of health complications experienced by newborns decreases, the scores on the Vineland and the Bayley increase. In other words, children with fewer neonatal health complications tend to have better adaptive behavior at age three; whereas this is true for development but the relationship is not as strong.

In terms of the relationship between the neonatal and postnatal environments, there is no significant relationship between the two. In the bivariate analysis, each of the three dimensions is independent of the other with one exception. A child's score on the neonatal health complications assessment is significantly correlated with the families' poverty status (rho=-0.132; p=0.044). The children with the greater number of neonatal

complications at birth are more likely to be living with a family that's average income is above the poverty line. Again, we encounter the relationship between risk and improved surroundings. The children with the greatest risk at birth, whether it was from prenatal cocaine exposure or some other contributing prenatal factor, appear to be living in better, less impoverished environments by the time they reach age three.

Postnatal Factors and Outcomes

In this section, I discuss the hypotheses pertaining to the social ecological model that represents the postnatal environment described in Chapter 4. It is presumed that the non-Black children living above poverty with psychologically stable caregivers who are more nurturing and who have better quality home environments and social support networks will exhibit better behavioral and developmental outcomes. This hypothesis is true to some extent. With the exception of the primary caregiver's psychosocial status, each dimension in the postnatal environment is significantly correlated with both behavior and development. The primary caregiver's level of depression is significantly related to development, but not to behavior. The children with lower developmental scores, tend to live with primary caregivers who report a higher level of depressive symptoms (rho=-0.129; p=0.049). The lack of a relationship between depression and behavior and the existing relationship between depression and development is quite interesting, but difficult to interpret due to the bi-directional nature of parent-child interaction. Do "problem" children cause caregivers to experience the symptoms of depression or does depression impair the caregivers' parenting capabilities? Further consideration is given to this dilemma in the subsequent chapter.

Table 5. 5: Correlation between Adaptive Behavior and Development, Prenatal Cocaine Exposure, and Environmental Factors, Spearman Correlation Coefficient, n=234

	Prenatal Cocaine Exposure	Behavior (Vineland)	Development (Bayley)	Neonatal Health (Hobel)
Prenatal Cocaine Exposure	1.000	--	--	--
Behavior (Vineland)	.066	1.000	--	--
Development (Bayley)	-.032	.473***	1.000	
Neonatal Risk Assessment	.106	-.143*	-.110°	1.000
PCG Depression Scale	-.155*	-.071	-.129*	-.085
Physical Environment	.012	.324***	.237***	.058
Parenting environment	.026	.387***	.276***	-.062
Family Social Support	-.104	.160**	.174**	.018
Child's Race	-.019	-.199**	-.256***	.059
Family below poverty	-.067	.000	-.109°	-.132*
Black Below Poverty	-.084	-.022	-.134*	-.085
Black Above poverty	.085	-.167**	-.085	.163*
Non-Black Below Poverty	.046	.054	.066	-.102
Non-Black Above Poverty	-.006	.191**	.247***	-.005
°p< .10; *p< .05; **p<.01; ***<.001 (2-tailed test)				

The mesosystem is characterized by the nature of the physical home environment and the parenting environment. According to the correlations shown in Table 5.5, there is a statistically significant relationship between the parenting and physical environments and behavior and development. Children with better behavioral and developmental outcomes tend to live in homes with more conducive parenting and physical

environments. The correlations for these measures, though statistically significant differ on the behavior and the development scales. The behavioral score has a higher correlation with the parenting (rho=0.387; p=0.000) and the physical (rho=0.324; p=0.000) environment than the development scale (rho=0.276; p=0.000; rho=0.237; p=0,000) respectively. It is possible that these small differences are due to the nature of the assessments, in that the behavioral assessment is conducted with the primary caregiver and an autonomous clinician conducts the developmental assessment.

One might argue that the primary caregiver's assessment of the child and of the nature of their home environment is biased resulting in socially desirable scores and stronger correlations between the measures that are dependent on the caregiver's assessment. Yet, this argument does not hold true when looking at the relationship between the depression score and outcomes and the family social support score and outcomes. In both cases the correlations with the Bayley, which is determined by the clinician, are higher than the correlations with the Vineland, the interviewer and caregivers joint assessment of the child's behavior. Therefore at this point it is unclear why the correlations differ.

The behavioral and the developmental assessments of children living in homes with a better quality of support are better than the assessments of children living in homes with less social support. Here, the developmental score correlates with the family social support scale at rho = 0.174 (p = 0.008) while the behavioral score is still significantly correlated but has a smaller coefficient (rho = 0.160) and higher p-value (p = 0.014).

At the macrosystem level, the socioeconomic status of the family is related to the family's level of social support and to the nature of the home environment (see Table

5.5). Families living below the poverty level received lower scores on the physical measure of the home environment (rho=-0.396; p=0.000), on the parenting dimension (rho=-0.209; p=0.001) and on the family social support scale (-0.135; p=0.039). Of the dummy variables created to classify the families' social and economic background, the non-Black families living above poverty had the strongest correlation with the outcome measures. Non-Black children living above poverty are more likely than the other groups of children to receive higher scores on the Vineland behavioral assessment (rho=0.191; p=0.003) and on the Bayley developmental scale (rho=0.247; p=0.000). In contrast, Black children have poorer developmental outcomes when they also live in poverty stricken households. Yet, Black children who live above the poverty line tend to score lower on the behavioral scale. The race-class effect observed here shows the complexity of the relationship between socioeconomic status and outcomes. This relationship is explored further in the subsequent chapter.

Table 5. 6: Complete Correlation Matrix, Spearman Correlation Coefficients, n=234

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) Cocaine Exposure	1.000	--	--	--	--	--	--	--	--	--	--	--	--	--
(2) Behavior (Vineland)	.066	1.000	--	--	--	--	--	--	--	--	--	--	--	--
(3) Devp'mt (Bayley)	-.032	.473*	1.000	--	--	--	--	--	--	--	--	--	--	--
(4) Neonatal Risk (Hobel)	.106	-.143*	-.110	1.000	--	--	--	--	--	--	--	--	--	--
(5) PCG Depression	-.155*	-.071	-.129*	-.085	1.000	--	--	--	--	--	--	--	--	--
(6) Physical Environment	.012	.324*	.237*	-.001	-.157*	1.000	--	--	--	--	--	--	--	--
(7) Parenting Environment	.026	.387*	.276*	-.062	-.179*	.568*	1.000	--	--	--	--	--	--	--
(8) Family Social Support	-.104	.160*	.174*	.018	-.185*	.204*	.081	1.000	--	--	--	--	--	--
(9) Child's Race	-.019	-.199*	-.256*	.059	-.007	-.437*	-.206*	.065	1.000	--	--	--	--	--
(10) Family Below Poverty	-.067	.000	-.109	-.132*	.143*	-.396*	-.209*	-.135*	.436*	1.000	--	--	--	--
(11) Black Below Poverty	-.084	-.022	-.134*	-.085	.118	-.421*	-.208*	-.094	.616*	.909*	1.000	--	--	--
(12) Black Above Poverty	.085	-.167*	-.085	.163*	.154*	.093	.055	.180*	.219*	-.698*	-.634*	1.000	--	--
(13) Non-Black Below Poverty	.046	.054	.066	-.102	.047	.090	.012	-.089	-.458*	.144*	-.282*	-.100	1.000	--
(14) Non-Black Above Poverty	-.006	.191*	.247*	-.005	-.020	.436*	.223*	-.020	-.848*	-.575*	-.522*	-.185*	-.083	1.000

*p<0.05 (2-tailed test)

Multidimensional Model of Behavior and Development

The primary hypothesis presented in this study is that, regardless of children's cocaine exposure status, the postnatal environment is a significant predictor of behavioral and developmental outcomes for pre-school aged children. This hypothesis is based on a compensatory theory of resilience and Bronfenbrenner's ecological theory of human development (see Chapter 3 for more detail). Based on the results from the bivariate analysis, it is clear that the neonatal and postnatal environment are significantly related to children's outcomes, whether they have been prenatally exposed to cocaine or not. In the following section, I use multivariate analysis to examine the relative contributions of biomedical, behavioral, and social factors on early childhood outcomes.

For the sake of simplicity, behavior and development have been examined comparatively throughout the bivariate analysis. However, behavior, as a construct is different from development. According to Ribes (1996), behavior has been used to explain the process of development, while development has been defined as the qualitative changes in behavior. The concept of behavioral development was introduced in the 1950s under the rubric of social learning theory. Since that time, theories about the behavioral and developmental processes have been developed and tested by sociologists, behaviorists, psychologists, biologists, ecologists, and so on (see Bijou and Ribes 1996 and Lerner 1983 for historical perspective). Roberts, Maddux, and Wright (1984:57) define the process of development as a process of systematic and measurable changes in behavior that occur "across the life span- from the prenatal period through life to death." In this vein, this research explores how prenatal, neonatal, and postnatal changes impact behavior and development, two processes that are significantly correlated. In this

research, I do not contend that development causes behavior, but the relationship between behavior and development is definitely worth exploring in future studies of "at-risk" children.

Behavior

In this study behavior refers to the intentional or unintentional actions exhibited by children as they learn how to adapt to their surroundings. The *Vineland Adaptive Behavior Scale* specifically measures the children's ability to demonstrate skills and to perform tasks that are necessary components of social interaction and individual survival. The behavior of children who have been prenatally exposed to cocaine has been of particular interest to those who care for these children at home and in public institutions because of the presumed behavioral problems associated with prenatal cocaine exposure. The early childhood behavior of this group of children is assumed to be a proxy for later life behaviors that may be problematic.

Among the children included in this study, prenatal cocaine exposure does not appear to be related to behavior. There are no significant differences between the PCE children and non-PCE children. Indeed the bivariate regression model is not significant. In model 2, adding a second biomedical component (i.e. neonatal risk) makes the model significant. Higher neonatal risk of physiological complications is associated with lower behavioral scores (see Table 5.7). Prenatal cocaine exposure is not correlated with adaptive behavior and it is not predictive of behavior in the final multivariate model. In Table 5.7, the multidimensional model (Model 3) is compared to the biomedical model (Model 2). Adding social contextual factors significantly improves the models fit and the explained variance.

The strongest predictor of adaptive behavior is the mesosystem, specifically, the nature of the parenting environment (Beta =0.278; p= 0.000). Adaptive behavior scores are highest among children who have a positive parenting environment. The neonatal environment is the second strongest predictor in the multidimensional model of behavior. Children who had greater neonatal risk tend to have lower behavioral scores three years later (Beta =-0.172; p=0.004). Last, Model 3 indicates that Black children living above the poverty line have poorer adaptive behavior than the below-poverty Blacks (Beta=-0.165; p=0.009). It is interesting to note that non-Blacks living above and below poverty have more similar behavior scores than poor Black children.

In the bivariate analysis, the families' level of social support and the quality of the physical home environment were significantly correlated with behavior, but they did not maintain their strength in the multivariate analysis. In general, the neonatal environment and aspects of the postnatal environment are significant predictors of behavior regardless of cocaine exposure status (Incremental F=7.292; p<0.001).

Table 5. 7: Multidimensional Models of Adaptive Behavior and Development, Standardized Regression Coefficients (p-values), n=234

	Vineland Adaptive Behavior Scales			Bayley Scales of Infant Development		
Variables	**1**	**2**	**3**	**4**	**5**	**6**
PRENATAL RISK FACTOR						
Cocaine Exposed	0.087 (0.187)	.087 (0.173)	0.093 (0.117)	-0.012 (0.851)	-0.011 (0.860)	-0.019 (0.755)
NEONATAL HEALTH FACTOR						
Hobel Neonatal	--	-0.218 (0.001)	-0.172 (0.004)	--	-0.268 (0.000)	-0.254 (0.000)
POSTNATAL SOCIAL FACTORS						
Depression Scale	--	--	-0.022 (0.715)	--	--	-0.108 (0.089)
Parenting Environment	--	--	0.278 (0.000)	--	--	0.175 (0.022)
Physical Home Environment	--	--	0.129 (0.120)	--	--	-0.013 (0.877)
Family Social Support	--	--	0.093 (0.133)	--	--	0.140 (0.030)
Black Above Poverty	--	--	-0.165 (0.009)	--	--	-0.044 (0.499)
Non-Black Below Poverty	--	--	0.037 (0.534)	--	--	0.065 (0.299)
Non-Black Above Poverty	--	--	0.071 (0.292)	--	--	0.181 (0.010)
R^2	0.007	0.055	0.254	0.000	0.072	0.194
F	1.751 (0.187)	6.723 (0.001)	8.495 (0.000)	0.035 (0.851)	8.974 (0.000)	5.993 (0.000)
Incremental F	Between Model 3 & 2	7.292		Between Model 6 & 5	4.8436	

Development

Like behavior, there are numerous ways of measuring development. Development can be defined in broad or narrow terms. In this study, the *Bayley Scales of Infant Development* are used to measure the development of each child's mental and

motor skills. Development refers to children's achievement of particular growth parameters in relation to their chronological age. Development is the process of growing and reaching physiological maturity. From a biomedical standpoint, development is a physiological process, but when placed within the context of the social environment, the physiological processes can be directly or indirectly influenced by external factors.

The Bayley measures the child's fine and gross motor skills, abstract reasoning, memory, learning and problem solving abilities. These domains reflect neurodevelopmental functioning, an area that can be compromised by the injection of cocaine (see Lauder 1991; Spear, Kirstein, Frambes 1989; Dow-Edwards 1991). According to Mayes and Bornstein (1995:253):

> Cocaine influences brain development directly through effects on developing neurotransmitter systems critical to neuronal differentiation and brain structure formation and indirectly through effects on blood flow to the developing fetal brain. . . Cocaine blocks the reuptake of dopamine, norepinephrine, and 5-HT by the presynaptic neuron [Swann, 1990], a process that is primarily responsible for inactivation of neurotransmitters.

There are certain parts of the brain that are insensitive to the effects of cocaine, but in fetal brain development, the effect cocaine has on the monoaminergic neurotransmitters is critical to brain structure and neuronal formation. Therefore, prenatal cocaine exposure places children at risk of poor neurodevelopmental functioning. Poor neurodevelopmental functioning can affect children's ability to react to stimuli, modulate arousal, and regulate their attention (Mayes and Bornstein 1995).

In the multivariate analysis shown in Table 5.7, prenatal cocaine exposure is not a significant predictor of development in any of the models. Similar to the behavior models, the first model (Model 4) is unremarkable. Model 5 shows the impact of adding in an additional biomedical factor. The model itself is significant and it explains 7.2% of

the variance compared to Model 4 where prenatal cocaine exposure does not explain any of the variability in development. Similar to the behavior model, children with higher neonatal risk tend to have lower developmental outcome scores. The final model, in which the social factors are added, is a significant improvement over the biomedical model (Model 5). The strength of the neonatal risk score changes very little when the postnatal factors are added. The addition of postnatal environmental factors enhances our understanding of development by explaining nearly 20% of the variance in development, which is nearly three times more than what the biomedical factors explained alone.

Of the postnatal factors included in the multidimensional model, there are significant effects from the micro-, meso-, exo-, and macro dimensions of the social field. At the microdimension, children whose primary caregivers have higher levels of depression are marginally more likely to have lower developmental scores (Beta = -0.108; p = 0.089). At the mesodimension, again the parenting environment is associated with developmental outcomes (Beta = 0.175; p = 0.022). However, the physical home environment, which was correlated with development in the bivariate analysis, is no longer significant in the multivariate analysis (Beta = -0.013; p = 0.877). In contrast to the behavior model, family social support is significantly associated with development (Beta = 0.140; p = 0.030). Specifically, children with higher development scores live with caregivers who have a more helpful social support network. Non-Black children living above poverty have significantly higher scores on the Bayley than the poor Blacks (Beta = 0.181; p = 0.010). Both poor non-Blacks and non-poor Black children have developmental scores similar to poor blacks. This means that social class shapes

developmental score differences among non-Blacks, but not among Blacks. The macro dimension also works differently for behavioral and developmental outcomes.

Summary

In conclusion, each dimension in the multidimensional model explains some portion of the variability in development and in behavior. The neonatal environment is the strongest predictor of outcomes, while the postnatal environment adds to our understanding of behavioral and developmental differences among children who are considered to be "at-risk" of early childhood delays. In the multivariate analysis, poor neonatal health and postnatal social and economic disadvantage place these children at greater risk for poor behavioral and development outcomes, while fewer neonatal complications and a positive home environment full of social support compensates for those risks.

The fact that there are no statistically significant differences between the children who were and who were not prenatally exposed to cocaine does not mean that children who have been prenatally exposed to cocaine are not "at risk." As indicated by their mean scores on the behavior and development scales, on average the PCE and non-PCE children from this at-risk sample scored below normal (≤ 100) on both scales. The lack of a significant difference between the two groups does indicate that factors other than prenatal cocaine exposure either help or hinder the development of positive early childhood outcomes. The sample of children in this study represent a group of children who are at risk of poor outcomes due to socioeconomic disadvantage, which is related to familial instability, poor parent-child interaction, maternal depression, and insufficient family and social support. The problems associated with prenatal cocaine exposure,

such as lower birth weight, perinatal health complications, and prematurity were not profound.

Again, the social and environmental factors considered in the multidimensional model were stronger predictors of outcomes for children at age 3 than their risk of prenatal cocaine exposure. In the concluding chapter, I expand upon these findings and I discuss their social and political implications for prenatally cocaine exposed children, their biological mothers, and the many people who care for them.

CHAPTER 5
RISK AND RESILIENCY IN EARLY CHILDHOOD

Early Childhood Risk

Prenatal Cocaine Exposure

The goal of this research has been to identify the relative influence of the prenatal, neonatal, and postnatal environments on the behavior and development of pre-school aged children. The children included in this study have been deemed "at-risk" because of their prenatal cocaine exposure. Specifically, this research has been designed to determine the effect that prenatal cocaine exposure, a prenatal risk factor, has on early childhood outcomes. As a whole, literature on prenatally cocaine exposed children is inconclusive due to contradictory results reported in the biomedical and behavioral literature.

The biomedical literature has taken on a teratogenic approach that focuses on the physiological effect cocaine has on the fetus and developing child. This problem-seeking approach presupposes that cocaine exposure has a direct organic effect on prenatally exposed children that will negatively influence later stage development. The biomedical model is limited because it typically fails to consider the social and environmental factors that can enhance or hinder behavior and development. The behavioral studies have tried to compare the behavioral and developmental outcomes for PCE and non-PCE children, which is difficult because of the methodological issues surrounding the study of prenatal

cocaine exposure and its long-term effects. In this research, I have attempted to address some of the concerns raised by previous researchers through the use of a prospective, longitudinal research study and a multidimensional theoretical model that incorporates the tenets of the biomedical, behavioral, and social sciences.

The findings presented in chapter 5 demonstrate the utility of a multidimensional approach to the study of prenatal cocaine exposure. Clearly, the combination of biomedical and sociological factors adds to our understanding risk and resilience among this group of children. In this multidimensional model, prenatal cocaine exposure served as the primary risk factor, yet it was not a significant predictor of outcomes. Prenatal cocaine exposure did not predict behavior or development when it was the only variable in the model or when it was compared to the other biomedical risk in the neonatal environment or the compensatory factors found in the postnatal environment.

The assessment of neonatal health complications, an indicator of future health problems, and the nature of the parenting environment were consistently correlated with behavior and with development in the bivariate and multivariate analyses. Children who experienced fewer complications neonatally had higher scores on the behavior scale and the developmental assessment. Additionally, the children living in more positive parenting environments with greater warmth and acceptance and more nurturing received higher scores on both scales.

Behavioral and developmental outcomes were affected differently by the other dimensions of the postnatal environment, including the primary caregivers' risk of depression, the physical condition of the home, the families' social support network, and the socioeconomic status of the families. The difference between behavior and

development was an unanticipated result. I had hypothesized that behavior and development would follow the same pathway. I developed this hypothesis as a means of testing the relationship between behavior and development, particularly as they relate to the popular beliefs about prenatally cocaine exposed children.

Children who have been prenatally exposed to cocaine have been characterized as exhibiting poor and often times extremely problematic behavior (Bendersky & Lewis 1998; Calhoun 1996; Howard, Williams, & McLaughlin 1994; Neuspiel 1993). The concern for the behavior of prenatally cocaine exposed children alludes to a relationship between behavior and development. It is presumed that children's prenatal exposure to cocaine has an impact on their physiological or neurological development resulting in their inability to regulate their behavior. Several researchers have found that cocaine has a direct and an indirect effect on the developing fetus and infant. These studies conducted on animals and infants have found a relationship between cocaine exposure and brain development, but they have not identified the direct or the long-term effects of the exposure. The following statement by Lester, Freier, and LaGasse (1995: 24) in an article titled "Prenatal Cocaine Exposure and Child Outcome: What Do We Really Know?" illustrates this point:

> . . . cocaine has a specific direct effect on brain function and an indirect effect through the influence of fetal nutritional status and it is possible that these direct and indirect effects have different influences on neurobehavioral functioning.

The work done by Lester and his associates reminds us that there are still a lot of unknowns when it comes to the effect of prenatal cocaine exposure. Lester and his peers conclude their analyses of the research on PCE by stating that "like prematurity, drug exposure can be viewed as another potential insult or injury to the developing fetus." For

some children it may have a profound effect and for others it may not affect them at all (Lester, Freier, & LaGasse, 1995: 32). Thus, the singular focus on prenatal cocaine exposure as the cause of behavioral and developmental problems for this group of children has diverted attention away from the more significant influences on these children's lives.

Poor Neonatal Health

The children included in this study of prenatal cocaine exposure exhibited a considerable number of neonatal health complications as compared to the norm. On average, both the PCE and the non-PCE children received approximately 15 points on the Hobel neonatal risk assessment. According to Hobel (1979), a score of 10 or higher is indicative of future health complications including a greater risk of premature mortality. Unlike, prenatal cocaine exposure, the biomedical health risk determined at birth was a significant predictor of behavior and development. The children with higher risk exhibited more behavioral and developmental problems.

This finding confirms that there is a direct relationship between biomedical factors and developmental outcomes. Even though the correlation between the neonatal risk and development was not strong, it was significant. Moreover, a relationship between neonatal risk and development does exist. Yet, even more convincing is the multivariate analysis that shows a reduction in the predictive validity of the developmental model when the social ecological factors are added. The neonatal health risk is a strong and significant predictor of development and it gets stronger when controlling for social ecological factors.

Again, this is not true for behavior. The biomedical health risk of the neonate is a significant predictor of behavior, but when controlling for the social ecological factors

that comprise the postnatal environment, the relationship between behavior and the neonatal environment is not as strong. The multidimensional model that includes the prenatal, neonatal, and postnatal factors explains a higher percentage of the variability in behavior than it does in development for this group of children.

These findings raise questions about whether or not behavior and development are inextricably intertwined. If biomedical factors do not have as large of an impact on behavior as they do on development and biomedical factors have less of an impact than social ecological factors, then how do we explain the problem behavior attributed to "at-risk" children? The "at-risk" child's exposure to prenatal and neonatal health risk does not serve as a sufficient explanation for poor behavioral outcomes, hence there is utility in taking a multidimensional approach that integrates biomedical, behavioral sociological risk factors.

Maternal Depression

Research has shown that psychological well-being is a significant predictor of poor health outcomes for children and pregnant women. Children of depressed mothers are more likely to suffer maltreatment and abuse (Kotch, Browne, Ringwalt, Stewart, Ruina, Holt, Lowman, and Jung 1995). Studies have also shown that women who suffer from depression are more likely to have problems consoling their children during times of distress, thus limiting the establishment of positive parent and child interaction (Zuckerman, Bauchner, Parker, and Cabral, 1990). Pregnant women who suffer with depression experience more complications during pregnancy resulting in poorer health outcomes for the mother and her child (Kitamura, Sugawara, Sugawara, Toda, and Shima 1996).

In this study, the biological mothers and the primary caregivers of the children at age three, have a considerable risk of suffering from depression. At birth, both the biological mothers who used cocaine and the non-cocaine users demonstrated a risk of experiencing moderate depression based on their mean score of 27 on the Center for Epidemiologic Studies-Depression (CES-D) scale (Wobie, Eyler, Behnke, & Conlon 1997). At age three, the mean score for both groups of primary caregivers was a little lower (mean =21) than the biological mothers' scores at the time of the child's birth, but it was still within the range for risk of moderate depression. The caregivers of the PCE children reported significantly lower scores than the primary caregivers of the non-PCE children demonstrating a pronounced improvement in the psychosocial status of the caregivers of PCE children overtime.

The change in the psychosocial status reflects a change in the biological mothers' status as the primary caregiver. By age 3, nearly half (49.5%) of the children who were prenatally exposed to cocaine are no longer living with their biological mothers. This differs considerably from the non-PCE group. The non-PCE children are more likely to be living with their biological mother, who is at greater risk of depression and comes from a low socioeconomic background, both of which place the children at risk of poor early childhood outcomes. The PCG's psychosocial status is an important component in the multidimensional model of behavior and development, because of the impact it has on parent-child interaction.

It is perhaps, because of the interaction between maternal depression and the parenting environment that it was not a significant predictor in the multidimensional models of behavior or development. The primary caregivers depression status was

significantly correlated with the measures of the home environment and the home was significantly correlated with behavior and development even when controlling for socioeconomic status and family support, the other postnatal factors. It is believed that the change in the primary caregivers of the prenatally cocaine exposed children not only reduced their risk of living with a depressed caregiver, but it has contributed to an improvement in the home environment. Although, we must not forget that the environment of this group of children is still not stellar, but it has improved.

Low Socioeconomic Status

In addition to the risk caused by prenatal cocaine exposure, health complications, and maternal depression, the children in this study are at risk of experiencing the deleterious effects of socioeconomic disadvantage. Researchers across numerous disciplines, studying a variety of circumstances have consistently demonstrated a correlation between race and income. This study is no different. The Blacks in the study are more likely to have lower incomes than the non-Blacks. Blacks are more likely to live below the poverty level than non-Blacks. These findings are intuitive, yet the relationship between socioeconomic status and early childhood outcomes is not so clear.

As mentioned earlier the pathway leading to positive behavioral outcomes differs from the developmental pathway. According to the multidimensional model, socioeconomic status is a stronger predictor of development than it is of behavior, but it is a significant predictor in both models. Poor children, regardless of race and Black children, regardless of income have poorer developmental outcomes than non-Black children living above the poverty line. Hence, poverty is also a significant predictor of developmental outcomes for this group of "at-risk" children. This could potentially be

explained by the fact that access to economic resources improves one's access to health care and in the developmental model, poor health is a sure sign of poor development.

Yet, the road to adaptive behavior is a little more complicated. The black children living above poverty appear to have poorer outcomes than Black and non-Black children living below poverty and non-Black children living above poverty. What this implies is that impoverished children and non-Black children have acquired more adaptive behavior skills than Black children who are living above the poverty line. What does this mean? Is race not a risk factor for poor behavior? Does being poor improve behavioral outcomes? In the bivariate analysis, race is significantly correlated with behavior, but income is not correlated with behavior. The correlation between race and behavior indicates that Black children tend to score lower on the adaptive behavior scale than non-Black children.

This research does not allow me to explain this anomaly, but it does question the relationship between poverty and behavior. Of the many conclusions that could be drawn, two come to mind: (1) perhaps, being poor places you at a greater risk of receiving a label that indicates behavioral problems, whereas poverty is not necessarily the cause of the problem and/or (2) poor children and non-Black children living above poverty may have greater access to services that encourage behavior modification and early childhood development, such as Head Start, pre-school, and other compensatory factors. The latter conclusion is well supported in the child abuse literature that has found a significant correlation between poverty and a families involvement with social service programs and early childhood interventions (Edwards, Tripp, Purcell, Danda, & Evans 2001; Lee & Goerge 1999). While the former theory about the effects of labeling

children has been supported by research on the self-fulfilling prophecy and other micro-level sociological theories (Allport 1988; Archibald 1992; Merton 1948).

Producers Of Resilience

Positive Parenting

Positive or healthy family functioning is a key factor in the resiliency research that addresses the needs of young children (Barnard 1994; Beardslee, Swatling, Hoke, Rothberg, Velde, Focht, and Podorefsky 1998; Beardslee, Wright, Salt, Drezner, Gladstone, Versage, and Rothberg 1997; Rak and Patterson 1996; Tarwater 1993). In poor families where the key players are a single mother and her child, positive family functioning is determined simply by the quality of parent child interaction. Mothers, or in the case of the families in this sample, primary caregivers who exhibit positive parent-child interaction through warmth and acceptance and the provision of academic stimulation, are rearing children who receive higher scores on the behavioral and the developmental assessment than their peers who are living in homes that are less nurturing.

The existence of a positive parenting environment enhances the behavior and developmental outcomes for the children in this study. The parenting environment is a better indicator of positive outcomes than the condition of the physical environment; demonstrating that the quality of the relationships inside of a home outweighs the quantity of material possessions found within the home. On a scale of 0 to 6, with 6 being the highest score, the average score on the parenting dimension is 4 meaning both the PCE and non-PCE children are living in homes that are slightly above average on the

parenting dimension, a dimension that is a significant predictor of behavior and development.

It is the strongest predictor of behavior in the multidimensional model. It is preceded by biomedical risk and the families' socioeconomic status in the developmental model. Therefore, children who are "at-risk of poor developmental outcomes because of physiological problems that may be exacerbated by poverty have the potential for reducing the problems caused by their poor health and impoverished status, by being placed in homes with caregivers who provide the children with warmth, acceptance, and encouragement.

Family and Social Support

Last, resiliency can be produced by not only enhancing the interaction between the primary caregiver and the child, but by enhancing the relationship between the primary caregiver and her peers. Family social support is a significant predictor of development among the children in this study. It is not a statistically significant predictor of behavior, but it is positively and significantly correlated with behavior and development in the bivariate analyses. For development, an increase in the quality of the social support available to the primary caregiver results in predictably higher scores, even when controlling for the other postnatal factors. In the behavioral model, family social support loses its significance when controlling for other predictors.

Taylor (1996) found that the support provided by kin was directly related to family organization and functioning, two factors that were directly related to behavioral outcomes for African-American adolescents. The parents who were able to draw upon the support of extended family were also more likely to be involved with their children's activities and the parents and the children expressed less psychological distress. For

these families, the number of problem behaviors exhibited by the child was significantly less (Taylor 1996). These findings point to the long-term impact family social support may have on the children in this study. It is not the strongest predictor of outcomes, but the results form the bivariate and multivariate analyses demonstrate a trend where family social support is a factor worth considering, because of its close association to maternal depression and the home environment, factors that clearly predict outcomes for pre-school aged children.

In this study social support is a measure of the primary caregivers perception of how helpful her extended family, the child's extended family, and social and professional agencies have been to her over the past year. According to Dolbier and Steinhardt (2000), the perception of support can be linked to health outcomes, the families' ability to deal with stressful life events, and one's psychological well-being. Therefore, as practitioners and interventionists begin to look at ways of improving the physiological and the psychological well-being of the women who care for "at-risk" children, it is important to consider the role extended family and external social supports can play in their lives.

Interventions And Implications

The multidimensional approach that has been examined in this study has helped explain the relationship between the biomedical aspects of the prenatal and neonatal environment, in addition to the social ecological characteristics of the postnatal environment and how these dimensions affect the behavior and development of a group of "at-risk" children. The multidimensional model has proven to be a considerably useful tool in explaining the biomedical, behavioral, and sociological pathways of development.

Biomedical risks can hinder the development of socially and economically disadvantaged children who do not have the benefit of a positive home environment that is surrounded with quality social support. The behavior of these children depends on the nature of the parenting environment and the relative risk of health related complications at birth.

These findings imply that children who have been prenatally exposed to cocaine are not doomed, but that they are resilient. Their resiliency depends on the reduction of postnatal health and social ecological risks. The practical implications of this research include the use of a wholistic perspective when developing and implementing interventions for pregnant drug users and their children. Low income women who suffer with depression and limited social and/or economic resources who become pregnant are "at-risk" of using cocaine and other drugs. Their pregnancy tends to complicate the situation. The problems associated with their impoverished status, depressive symptomology, and drug use can be passed on to their children in the form of prenatal, neonatal, and postnatal risks. Therefore, the multiple needs of the mother need to be addressed, as do the multiple needs of the child.

Interventions need not only include the child who is either exhibiting problems or is at risk of experiencing problems, but they need to include the biological parents and/or the child's primary caregiver, and the institutional supports available to the family. In order to design an intervention that addresses multiple audiences with multiple needs the design team needs to be interdisciplinary. Thus the theoretical implication of this work is to promote interdisciplinary research and teaching. Researchers need to cross their disciplinary boundaries by incorporating the sound principles of the biomedical, behavioral, and social sciences in their work. Educators need to collaborate with one

another as a means of identifying the best practices in their fields that can be reproduced in their scholarly work and their training of practitioners and future scholars.

Limitations And Recommendations

As in any research the recommendations presented in this study are confined by the limits of the data. The data that support the utility of a multidimensional approach to the study of prenatal cocaine exposure and the creation of evidence-based interventions comes from a research project that has a sound methodological and theoretical foundation, but limited data. The sample size is relatively small and non-representative of this country's social demographics.

The majority of the children included in the study are African-American, poor, and living in communities that range from rural to suburban based on population size and geographic location. Therefore, it is not possible to assume that the findings presented here will automatically be reproduced in a study that utilizes a different sample of children and families. However, it is safe to say that among this group of 'at-risk" women and children there are multiple dimensions of influence on the children's outcomes at age three and the saliency of the risk and resiliency factors introduced in this study are worth exploring in future research studies that involve this sample and others.

Because this study only uses a cross section of the data collected during a longitudinal study on prenatal cocaine exposure, it fails to contribute to our understanding of how biomedical, behavioral, and sociological factors influence cocaine exposed children's entire life course trajectory, but this study will begin a long discussion on the multiple influences from the prenatal, neonatal, and postnatal environments on childhood and later life development. I invite other researchers to join the discussion and

participate in the production of practical solutions to the problems that face "at-risk" children and their families.

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BIOGRAPHICAL SKETCH

Carla Denise Armbrister Edwards began her academic career at the University of Pennsylvania where she received two degrees and graduated with academic distinction. In 1992, she received a Bachelor of Arts degree in sociology with a concentration in deviance and social control. One year later, she received a master's degree in education with a concentration in psychological services. Upon completing her master's degree, she pursued a career in higher education. She served one year as a Residential Instructor at the University of South Florida. Then in 1994, she began serving as an Assistant Dean in the College of Arts and Sciences at the University of Pennsylvania.

As a native Floridian, Carladenise decided to return home to pursue her doctorate in sociology. She began working on her doctorate at the University of Florida in 1997. During her tenure in Gainesville, she served as a research assistant on numerous projects, a sociology instructor at the University of Florida and at Santa Fe Community College, and the project coordinator and co-principal investigator on the Healthy Families Jacksonville Evaluation Project. Presently, she is serving as a Presidential Management Intern in the Center for Mental Health Services in the Department of Health and Human Services in Rockville, Maryland.

Carladenise is the wife of Herman A. Edwards, the daughter of Anthony and Juanita Armbrister, and the sister to the late Andrew P. Armbrister (deceased April 4, 2001). Carladenise has been actively involved in Alachua County's Election Board, Big Brother-Big Sister of Philadelphia, and Zeta Phi Beta Sorority, Incorporated.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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